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October 15, 1975

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Volume 32, Number 7, October 15, 1975

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

HOLLOWAY, J.A., Survey of image processing methods for radiography, 31:16451
HOLLWEG, J.V., Hydromagnetic waves in interplanetary space, 31:17953
HOLMBERG, E.B., Distribution of clusters of galaxies as related to galactic absorption, 31:16040
HOLMES, J.J., See BATES, J.F., 31:17444

Subjects

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Examples:

NUCLEAR POWER PLANTS/REACTOR LICENSING
Experience acquired in the design and construction of operating plants (German Federal Republic), 31:19104
NUCLEAR POWER PLANTS/REACTOR SAFETY
Conception of radiation safety in atomic electric power plants, 31:15032 (CONF-701074-P1)
NUCLEAR POWER PLANTS/SITE SELECTION
Safety-related site parameters for nuclear power plants, 31:19052 (WASH-1361)
Status and development of nuclear power in the Federal Republic of Germany, 31:19105
NUCLEAR PROPERTIES/RESEARCH PROGRAMS
Accelerator physics group progress report, July--December 1973 (Research summaries), 31:18544 (INS-R-139)

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

17606 (ANL/HEP-7440, pp I.1-I.12) ACCELERATED POLARIZED PROTONS AT THE ZGS. Ratner, L. G. **(Argonne National Lab., IL).** Feb 1974.
From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).
In symposium on high-energy physics with polarized beams.

is indexed as:

ARGONNE NATIONAL LAB., ILL. (USA)
Accelerated polarized protons at the ZGS, 31:17606 (ANL/HEP-7440)
Acceleration of polarized protons in synchrotrons, 31:17692 (ANL/HEP-7440)
Analysis of population, birth, and death statistics in the counties surrounding the Big Rock Point Nuclear Power Station, Charlevoix County, Michigan, 31:16552 (ANL-8149)
Argonne polarized target facilities, 31:17762 (ANL/HEP-7440)
Calculation of transient fission-gas release from oxide fuels, 31:19031 (ANL-8143)

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1164	31:19025	Dep. NTIS, $16.00
1359	31:16524	Dep. NTIS, $10.60
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WCAP-	**(Misc.)**	
7906	31:19053	Dep. NTIS, $5.50
XDC-		
60-3-66	31:18403	Dep. NTIS, $7.25
XN-	**(Non-ERDA)**	
74-21(Rev.1)	31:19054	
209(Suppl.4) (Rev.1)	31:18750	Exxon, Richland, WA
Y-		
1966	31:19188	Dep. NTIS, $4.00

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

16694 (AECL-5037) CHEMISTRY AND MATERIALS DIVISION PROGRESS REPORT, OCTOBER 1 TO DECEMBER 31, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1975. 138p. Dep. NTIS (US Sales Only) $10.00. AECL $3.00.

Research is reported in the following areas: solid state science, general chemistry, physical chemistry, and materials science. Publications resulting from this research are listed. (MCG)

16695 AMERICAN CHEMICAL SOCIETY 169th NATIONAL MEETING, PHILADELPHIA, PENNSYLVANIA, APRIL 6-11, 1975. Abstracts of Papers. Washington, DC; American Chemical Society (1975). vp. (CONF-750410-(Absts.)). $9.00.

From 169th national meeting, American Chemical Society; Philadelphia, Pennsylvania, USA (6 Apr 1975).

Analytical and Separations Chemistry

Refer also to abstracts 17185, 17240, and 17356.

16696 CONTAMINANTS IN FOOD: ANALYTICAL PROBLEMS AND ACHIEVEMENTS: ANALYTICAL PROBLEMS AND ACHIEVEMENTS. Egan, H.; Sawyer, R. (Lab. of the Government Chemist, London). Toxicology; 4: No. 2, 245-252(May 1975).

From 4th international congress of food science and technology; Madrid, Spain (22 Sep 1974).

In evaluating the toxicological significance of such contaminants as trace metals, polynuclear aromatic hydrocarbons, mycotoxins, pesticides and nitrosamines, analytical chemistry plays an important role. The detection and identification of these in various foods at the mg/kg levels has posed some difficult analytical problems. Considerable progress has been made in this field in the past decade, however, and opportunity is taken to review the achievements in terms of specificity and sensitivity for each class of contaminant. (auth)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 17213, 17322–17335, 17338, 17339, and 17344.

16697 (BNWL-1950(Pt. 4), pp 17-22) ACTIVATION ANALYSIS TECHNOLOGY. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Instrumental and chemical techniques were developed for the determination of rare element tracers which are being used for the study of atmospheric processes in storm systems. A comparison of the existing neutron activation analysis techniques with those possible by laser excitation indicates that much can be done if laser excitation fluorescence analysis can be used for future programs. A method was developed to analyze Pu concentrations at relatively low levels in high concentrations of beta-gamma radioactivity, using the spontaneous fission and (α,n) neutrons. The neutrons are measured by metal foil neutron activation in radiation fields too intense for normal electronic equipment. (auth)

16698 (BNWL-1950(Pt. 4), pp 38-39) METHODS FOR MEDICAL RESEARCH. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Methods are described for the determination of total-body nitrogen in animals by measuring ^{11}C in expired air following neutron irradiation. Results of measurements in rats are reported. (CH)

16699 (CONF-720902-, pp 191-203) NEUTRON ACTIVATION ANALYSIS STUDIES OF SELECTED PORTIONS OF THE MAHONING RIVER SYSTEM USING ^{252}Cf. Abram, E.; Cordon, P. J.; Hazari, A. S. G.; Kline, R.; Mahadeviah, L.; Mooney, E. Jr. (Youngstown State Univ., OH). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A neutron activation analysis study was conducted on portions of the Mahoning River located in eastern Ohio and western Pennsylvania. This river occurs in a highly populated area and is used extensively by numerous industries, including four steel mills, located in the area. Detailed analysis of water and sediment samples indicate the presence of ten different elements. These are sodium, chlorine, bromine, copper, manganese, magnesium, calcium, vanadium, potassium and aluminum. (auth)

16700 (CONF-7410123-, pp 9.29-9.33) APPLICATION OF NEUTRON ACTIVATION ANALYSIS IN MEDICAL AND BIOLOGICAL RESEARCH. Schramel, P. (Forschungsreaktor, Neuherberg, Ger.). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The application of neutron activation analysis for the determination of trace elements in biological material is described. The main method for determining trace elements at our laboratory is radiochemical separation after irradiation. It is possible to detect up to 30 elements in one sample of about 100 mg. Some aspects of routine application are given as well in the field of environmental studies. A short comparison to the atomic absorption method will follow that attempts to work out the different application fields of both the methods. (auth)

16701 (IEA-332) INSTALLATION OF AN ACTIVATION ANALYSIS SYSTEM WITH 14-MeV NEUTRONS. Calado, C. E.; Machado, E. L. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Apr 1974. 43p. (In Portuguese). Dep. NTIS (US Sales Only) $5.25.

A description is given of the fast neutron activation analysis system developed at the Instituto de Energia Atômica. Samples are analyzed by direct comparison with standards containing known quantities of the elements being evaluated. Activation of the sample by 14-MeV neutrons, produced by the $^3H(d,n)^4He$ reaction using a 400 KV Van de Graaff Accelerator is followed by pneumatic transfer to a distant counter in times as short as 0.5 s. The sample activity is measured using either a 3'' × 3'' NaI(Tl) crystal or a 41-cm^3 Ge(Li) detector coupled to a 1024 channel analyzer and the fast neutron flux is monitored by measuring the activity of a fixed position sample irradiated at the same time as the test sample. The main sources of error are analyzed and detection sensitivities for different elements are

presented. In preliminary runs, a sensitivity of 25 ppm for oxygen in steel was measured. (auth)

16702 (NIM-1718) DETERMINATION OF SILVER IN LEAD, COPPER, AND ZINC CONCENTRATES BY INSTRUMENTAL NEUTRON-ACTIVATION ANALYSIS. Eddy, B. T.; Pearton, D. C. G.; Bibby, D. M. (National Inst. for Metallurgy, Johannesburg (South Africa)). 9 May 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

Instrumental neutron activation analysis was used in the determination of silver in a number of copper, lead, and zinc ores and concentrates. By the use of epithermal activation, silver could be determined within 4 days of irradiation, with a limit of detection of about 10 ppM and a precision of 2.7% at the concentration level of 600 ppM. An increase in the decay time to 12 days improved the limit of detection to about 3 ppM and the precision to 1.7% at the same concentration level as before. The total time required for the analysis was about 1 hour per sample excluding the decay time, which varied from 4 to 12 days depending on the precision required. (auth)

16703 (NP-20501) SURFACE ANALYSIS IN METALS BY MEANS OF CHARGED PARTICLE INDUCED REACTIONS. Lorenzen, J. (Uppsala Univ. (Sweden)). 1975. 38p.

Thesis.

Some experimental investigations are described, which add to the analytical techniques for the quantitative measurement of low concentrations and their depth determination in metal surfaces by means of charged particle induced reactions. The methods described are Rutherford scattering analysis, ion-induced X-ray emission analysis, and nuclear reaction analysis. Sectioning techniques, scanning techniques and resonance and non-resonant reactions are described for depth distribution studies. (SW)

16704 (ORO-3398-45, pp 73-76) CHARGED-PARTICLE ACTIVATION ANALYSIS. Schweikert, E. A.; Debrun, J. L.; Thomas, J. P.; Beck, J. N.; Swindle, D. L.; Francis, G.; Dabney, S. A.; McGinley, J. R.; Riddle, D. C.; Burton, T. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

A discussion of research activities designed to broaden the array of methods available for elemental trace analysis with application of nuclear reactions induced by charged particles is presented. An additional objective has been the study of methods for localizing impurities based on the energy dependent penetration of charged particles. This is being complemented with recently initiated studies on novel techniques based on very short-lived nuclides and detection methods other than counting. (3 figures, 4 tables) (SDF)

16705 PRECISE AND RAPID DETERMINATION OF TRACE AMOUNTS OF URANIUM IN INORGANIC SAMPLES BY NEUTRON ACTIVATION AND TBP EXTRACTION. Steinnes, E. (Institutt for Atomenergi, Kjeller, Norway). Anal. Chim. Acta; 76: No. 2, 457-463(Jun 1975).

16706 NEUTRON ACTIVATION METHOD WITH USE OF SOLID-STATE DETECTORS IN THE DETERMINATION OF NATURAL URANIUM IN BIOLOGICAL MATERIALS. Golubenkov, A. M.; Malenchenko, A. F. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 42-48(1975). (In Russian).

The modification of the neutron-activation method was studied using solid dielectric detectors and irradiation in a liquid phase. High sensitivity of the technique for the determination of uranium in biological material is shown. (auth)

16707 NEUTRON-RADIATION DETERMINATION OF THE IRON CONTENT IN COALS. Pak, Yu. N.; Starchik, L. P. Koks Khim.; 11: 10-11(1974). (In Russian).

Forty coal samples were irradiated with neutrons at 5×10^6 n/sec. The mean square error for determination of iron was < 0.5% at iron contents of 0.5 to 8% and ash contents of 5 to 43%. (MCG)

16708 ACTIVATION DETERMINATION OF NITROGEN IN PETROLEUM. Botvina, A. Ya.; Kazachevskii, I. V.; Sokol'skii, V. V. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 86-87 (1974). (In Russian).

The possibility of determining nitrogen in petroleum by an activation method was investigated. Fast-neutron irradiation of pure hydrocarbons induces a nuclear reaction in which ^{13}N is formed. The amount of ^{13}N formed in several hydrocarbons and in samples of petroleum from the Kazakhstan deposits was determined by an activation method. However, since the nitrogen contents of the petroleum and the "pseudo" nitrogen in pure hydrocarbons are comparable, the analysis cannot be made with sufficient precision. (2 tables) (tr-auth)

16709 NEUTRON ACTIVATION ANALYSIS OF UNDERGROUND WATER SAMPLES TAKEN FROM BLACKFOOT DISEASE AFFECTED AREA. Chen, H. C. (National Tsing-Hua Univ., Hsinchu, Taiwan). Nucl. Sci. J. (Taiwan); 12: No. 1, 23-28 (Mar 1975).

Neutron activation analysis method was used to identify the trace elements in the deep-well water samples of the blackfoot disease affected area. A Ge(Li) detector coupled with a 4096-channel pulse height analyzer was used to detect the irradiated water samples. Six elements Br, Mn, As, Co, Se and Zn have been identified in the water samples. The trace element concentrations were determined quantitatively by means of comparison with standard samples containing known contents. Computer program was used for data analysis. (auth)

16710 HAIR AS AN INDICATOR OF MULTIELEMENT EXPOSURE OF POPULATION GROUPS. Chattopadhyay, A.; Jervis, R. E. (Univ. of Toronto). pp 31-38 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

Scalp hair is becoming well recognized as an invaluable tissue for monitoring human environmental exposure. Simultaneous determination of a number of metals in hair can be used to evaluate the total body accumulation due to exposure. In this laboratory, a nuclear method for multielement hair analysis has been developed by combining neutron and photon activation analyses to detect part per million concentrations of antimony, arsenic, bromine, cadmium, calcium, cobalt, iron, lead, mercury, nickel, selenium, sodium, zinc, and zirconium in hair. The concentrations of As, Cd and Pb have been observed to be the most elevated among urban residents near two Pb smelters compared with residents in urban control and rural communities. Lead in hair has been studied in detail by analyzing more than 250 samples. The variation of Pb content with respect to color of hair and to age and sex of the donor are reported here. Children residing close to smelters, especially the boys, have been observed to show the most elevated hair Pb levels, some up to ten times normal and some of them have been treated for Pb poisoning. Further, by analyzing the sequential growth sections along the length of hair strands it has been possible to deduce the period of maximum exposure and some history of the exposure. (auth)

16711 SELECTIVE DETERMINATION OF CHROMIUM IN BIOLOGICAL AND ENVIRONMENTAL MATRICES. McClendon, L. T. (National Bureau of Standards, Washington, DC). pp 255-257 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

Chromium occurs in many biological and environmental materials but only in trace amounts (ppM level), which makes the determination by usual chemical methods very difficult and sometimes impossible. Destructive neutron activation analysis, utilizing the reaction $^{50}Cr(n,gamma)^{51}Cr$, can eliminate many of the difficulties encountered with other techniques. A detailed description of chromium determination in various biological (e.g. liver and urine) and environmental (e.g. coal and fly ash) samples using the NBS Reactor, coupled with a very selective radiochemical separation procedure, is discussed. (auth)

16712 DETERMINATION OF IODINE IN URINE BY NEUTRON ACTIVATION ANALYSIS: APPLICATION OF THE SZILARD--CHALMERS EFFECT. Biotcky, A. J.; Rack, E. P.; Duven, D. M.; Ecklund, R. E.; Grauer, W. M. (Veterans Administration Hospital, Omaha). pp 259-264 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

A procedure making use of the Szilard--Chalmers effect is outlined for the simple, rapid, quantitative determination of total iodine (greater than or equal to 0.05 mu g/ml) in urine using ^{128}I neutron activation. The ^{128}I reactions activated by radiative neutron capture (Szilard-Chalmers effect) in urine are discussed. The procedure utilizing a low power nuclear reactor (approximately 1.1×10^{11} n/cm^2-sec) consisted of (a) irradiating urine samples, (b) recovering the ^{128}I in urine by nitric acid-hydrogen peroxide oxidation and carbon-tetrachloride solvent extraction, (c) performing a radioassay for ^{128}I using a Ge (Li) detector and (d) determining the ^{128}I extraction yields in the oxidation-extraction procedure. The total I concentration in samples determined varied from less than 0.1 mu g/ml to 2000 mu g/ml. The precision of the

technique, which lends itself well to routine analysis, is less than 6 percent. Comparison between the results obtained by the discussed procedure and values obtained independently were good. Clinical applications of the method are outlined. (auth)

16713 DETERMINATION OF TOXIC TRACE ELEMENTS IN BODY FLUID REFERENCE SAMPLES. Gills, T. E.; McClendon, L. T.; Maienthal, E. J.; Becker, D. A.; Durst, R. A.; LaFleur, P. D. (National Bureau of Standards, Washington, DC). pp 273-280 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

The measurement of elemental concentration in body fluids has been widely used to give indication of exposures to certain toxic materials and/or a measure of body burden. To understand fully the toxicological effect of these trace elements on our physiological system, meaningful analytical data are required along with accurate standards or reference samples. The National Bureau of Standards has prepared for the National Institute for Occupational Safety and Health (NIOSH) a number of reference samples containing selected toxic trace elements in body fluids. The reference samples produced include mercury in urine at three concentration levels, five elements (Se, Cu, As, Ni and Cr) in freeze-dried urine at two levels, fluorine in freeze-dried urine at two levels and lead in blood at two concentration levels. These reference samples have been found to be extremely useful for the evaluation of field and laboratory analytical methods for the analysis of toxic trace elements. In particular the use of at least two calibration points (i.e., "normal" and "elevated" levels) for a given matrix provides a more positive calibration for most analytical techniques over the range of interest for occupational toxicological levels of exposure. (auth)

16714 RARE-EARTH ABUNDANCES IN INDIAN KIMBERLITE. Paul, D. K. (Univ. of Leeds, Eng.); Potts, P. J.; Gibson, I. L.; Harris, P. G. Earth Planet. Sci. Lett.; 25: No. 2, 151-158(Mar 1975).

Abundances of some rare-earth elements (REE), together with Hf, Ta, Th, and Ba have been determined by neutron activation analyses in twelve kimberlite samples from Peninsular India. The kimberlites have fractionated REE patterns with enrichment of light rare earths; La/Yb ratio varies from 39 to 166. A systematic relationship exists between the total rare-earth abundances and the petrochemistry of the rocks. The rare-earth abundances observed in the kimberlites are consistent with their derivation by partial melting of a hydrous garnet peridotite mantle and subsequent fractional crystallization of the melt. (auth)

16715 MEASUREMENT OF INTRATHYROIDAL IODINE BY NEUTRON ACTIVATION ANALYSIS. Robertson, I.; Boddy, K.; Hooper, M. J.; Stevenson, R. D.; Wilson, G. M. (Scottish Universities Research and Reactor Centre, Glasgow). Proc. R. Soc. Med.; 68: No. 6, 384-386(Jun 1975).

Measurements of total intrathyroidal iodine are of considerable potential clinical value. A technique based on in vivo neutron activation analysis was therefore developed. The front section of the neck was irradiated with a suitable beam of neutrons and the low level of iodine-128 radioactivity induced in the thyroid gland was subsequently measured using a high sensitivity external monitor. Comparison of the counting rate with that from mock thyroid glands, contained in appropriate neck phantoms and treated identically, provided a measurement of the total iodine content of the thyroid. A boron filtered neutron beam obtained from the central vertical stringer of the UTR-300 reactor was shown to be more suitable, but less convenient for clinical studies, than neutrons from a ^{252}Cf neutron source. The counting error for a gland containing 10 mg I was approximately 2% and the minimum detectable amount 0.3 mg I (neutron dose 20 rem, gamma dose 2 rem) following activation by the filtered reactor neutron beam, compared with errors in the range 8.3% to 3.4% and corresponding minimum detectable amounts of 1.7 mg I (total radiation dose 10 rem) and 0.6 mg I (total radiation dose 23 rem) for ^{252}Cf neutrons. The radiation doses were comparable with or less than the doses received in standard radioiodine tests, for all of the activation conditions studied. The potential of ^{252}Cf neutron sources for clinical studies involving partial body in vivo activation analysis is emphasized. (UK)

16716 ORGANIC OXYGEN DETERMINATION OF KENTUCKY NO. 9 COAL BY FAST-NEUTRON ACTIVATION ANALYSIS. Hamrin, C. E. Fuel; 54: No. 1, 70-71(Jan 1975).

Oxygen was determined in sized coal and in a low-temperature ash by a high-precision fast neutron activation technique employing a multiscaler neutron-flux-normalisation procedure and precise timing. The difference between the coal and low-temperature ash oxygen contents is believed to be the best estimate of organic oxygen using a direct-determination method. The degree of precision is considered adequate for the routine study of homogenized coal samples. (auth)

16717 EXTRACTION–RADIOACTIVATION DETERMINATION OF GOLD IN ROCKS. Serebrennikova, O. V.; Glukhov, G. G. Tr. Tomsk. Gos. Univ.; No. 240, 61-68(1973). (In Russian).

The sample (0.3 g) and an appropriate standard are irradiated for 10 hr in a flux of $\approx 10^{13}$ neutrons cm^2/sec. The irradiated material is then dissolved in aqua regia in the presence of Au carrier, the solution is evaporated to dryness, the residue is evaporated to a paste with aqua regia and then with HCl, and the residue is dissolved in 0.25M HCl. The Au is then extracted into a sub-stoichiometric amount of a solution of a dialkyl sulfide in $CHCl_3$ (alkyl is propyl, butyl, pentyl, heptyl or octyl), and the γ-activity of ^{198}Au in the extract is measured at 0.412 MeV with a γ spectrometer [NaI(Tl) detector]. (REF. ZH.)

16718 DETERMINATION OF CADMIUM IN SEA WATER BY RADIOACTIVATION. Weiss, H. V. (Naval Undersea Center, San Diego, CA); Chew, K.; Guttman, M.; Host, A. Anal. Chim. Acta; 73: No. 1, 173-176(1974).

Cadmium was determined in seawater by a neutron activation technique, which provides the basis for unequivocal identification and is at the same time inherently sensitive. Cadmium is isolated from seawater by cocrystallization with 8-hydroxyquinoline (oxine). The radiochemical purification scheme in the determination of radioinduced ^{115}Cd–^{115}In is reported and the results of replicate analyses of two different volumes of a stock seawater sample are given. Also several analyses were performed to demonstrate that cadmium and mercury are determinable on the same sample of seawater. (auth)

16719 NON-DESTRUCTIVE DETERMINATION OF SILICON IN ALUMINIUM–SILICON ALLOYS BY NEUTRON ACTIVATION ANALYSIS WITH A ^{227}Ac–Be ISOTOPE NEUTRON SOURCE. Alaerts, L.; Op de Beeck, J. P.; Hoste, J. (Ghent State Univ.). Anal. Chim. Acta; 73: No. 1, 53-59(Nov 1974).

A method was developed for the accurate determination of silicon in binary Al–Si alloys by instrumental neutron activation analysis with the aid of an ^{227}Ac–Be isotope neutron source. Discs, weighing ca. 4 g, are irradiated at the maximum of the fast flux gradient in a rabbit lined internally with two layers of cadmium foil. Each irradiation is followed by an integral mode counting with discriminator baseline setting at 1400 keV. Standards consist of discs from high-purity semiconductor silicon and aluminium (99.99%) metal. An iterative calculation procedure yields results with a relative precision from 0.6 to 8.1% for silicon contents between 13.5 and 0.5%. Triplicate analysis requires 21 min. (auth)

16720 PURITY CONTROL OF NIOBIUM AND TANTALUM SAMPLES BY DIRECT GAMMA SPECTROMETRY AFTER IRRADIATION WITH 10 MeV PROTONS. Barrandon, J. N.; Benaben, P.; Debrun, J. L.; Valladon, M. (CNRS, Orleans Cedex, France). Anal. Chim. Acta; 73: No. 1, 39-48(Nov 1974). (In French).

Nondestructive analysis of samples of niobium and tantalum was achieved by activation with 10-MeV protons and γ spectrometry. Niobium and molybdenum were detected and determined in tantalum, as well as molybdenum and tungsten in niobium. Upper limits of concentration were established for over thirty other undetected elements; most of these limits are below the ppM level, and some reach the ppB level. (auth)

16721 DETERMINATION OF ALUMINIUM IN SILICATE ROCKS BY 14-MeV NEUTRON ACTIVATION ANALYSIS. Huysmans, K.; Gijbels, R.; Hoste, J. (Ghent State Univ.). Anal. Chim. Acta; 73: No. 1, 61-72(Nov 1974).

Aluminum was determined in various standard rocks by 14-MeV neutron activation analysis. The induced ^{27}Mg activity (1.01 MeV photopeak) was counted with a multichannel analyser, equipped with Bartosek's dead-time stabilizer system. Aluminum standards were prepared by mixing silica and alumina. Correction was made for the interfering reaction $^{30}Si(n,\alpha)^{27}Mg$ by counting the 1.78 MeV peak, 10 min after irradiation. The mean coefficient of variation on a single determination was 2.8% at the 6 to 10% aluminum level. (auth)

16722 DETERMINATION OF URANIUM IN BIOLOGICAL MATERIAL BY THE FISSION TRACK METHOD. Wiechen, A. (Bundesanstalt fuer Milchforschung, Kiel). pp 292-298 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs- und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

A method for the determination of U in biological samples was developed using milk as the sample. The milk was processed to powder, ashed, pressed into tablets, fixed to a polycarbonate foil, and irradiated with thermal neutrons. After etching of the foils, the fission tracks were counted. Typical fission tracks obtained with samples containing 100, 10, and 1 ppb were given. To increase the sensitivity of the method the U was enriched by precipitation of the ashed solution. A five times greater sensitivity was obtained. The only interferring element in the U determination is ^{239}Pu. (JSR)

16723 DRYING AND ASHING OF BIOLOGICAL SAMPLES IN THE TRACE ELEMENT DETERMINATION BY NEUTRON ACTIVATION ANALYSIS. Behne, D.; Matamba, P. A. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany)). Z. Anal. Chem.; 274: No. 2, 195-197(1975). (In German).

2 tabs.; 5 refs.

The changes in the element content of blood serum samples due to drying and ashing procedures were investigated for those trace elements that could be determined by instrumental neutron activation analysis after long-time irradiation (Ag, Co, Cr, Cs, Fe, Rb, Sb, Sc, Se, and Zn). For some elements, lower concentrations were found after oven-drying at 90°C and after low temperature ashing than after freeze-drying. In the case of selenium, which is known to form several volatile compounds, no differences could be detected between the freeze-dried, oven-dried and ashed samples. (auth)

16724 SIMPLE AND PRECISE DETERMINATION OF Zn AND Cd IN HUMAN LIVER BY NEUTRON ACTIVATION ANALYSIS. Halvorsen, C.; Steinnes, E. (Institutt for Atomenergi, Kjeller (Norway). Isotope Labs.). Z. Anal. Chem.; 274: No. 2, 199-202 (1975).

3 tabs.; 14 refs.

A simple neutron activation method for the simultaneous determination of Zn and Cd in biological tissue is described. After $HNO_3-H_2SO_4$ digestion of the irradiated samples, a one-step anion exchange separation is used for the isolation of ^{65}Zn and ^{115}Cd with about 98% chemical yield. The precision from duplicate analyses of human liver is 3 to 4% for Zn in the concentration range of 20 to 120 ppM and about 5% for Cd in the 1-ppM region. (auth)

16725 AUTOMATICALLY CONTROLLED RADIOACTIVATION-ANALYZER. Fujii, I.; Muto, H.; Onodera, K.; Inoue, T. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1973-18879/B/. 11 Apr 1969. 4p. (In Japanese).

The purpose of the present invention is to provide a radioactivation analyzer that can carry out automatically the quantitative analysis of multiple elements. The operation of this system is as follows: A sample is transferred to the neutron irradiating position through a conveyor tube. Completion of this action is detected by a sample arrival detector, and a beam shutter is opened to irradiate the sample with a neutron beam for a predetermined duration. After the completion of the irradiation, the beam shutter closes, and the sample is sent back to the original position. The radiation processor for processing the signal from the radiation detector is activated after a predetermined cooling time, and the measurement is made for a predetermined time interval. After the measurement, a disabling signal is sent to the indicator which indicates the completion of measurement of one sample. In this manner, the photoelectric peak area for the γ rays of the radioactive nuclides produced from the element to be analyzed is obtained from the data stored in the radiation data processor. The final step is made by using an electronic scanner. (JA)

16726 COMPARISON OF ATOMIC ABSORPTION AND NEUTRON ACTIVATION ANALYSES FOR THE DETERMINATION OF SILVER, CHROMIUM, AND ZINC IN VARIOUS MARINE ORGANISMS. Greig, R. A. (Milford Lab., CT). Anal. Chem.; 47: No. 9, 1682-1684(Aug 1975).

Results of the comparative data obtained by the two techniques are presented. Significance of the data is discussed briefly. (LK)

16727 EVALUATION OF LYOPHILIZATION FOR THE PRECONCENTRATION OF NATURAL WATER SAMPLES PRIOR TO NEUTRON ACTIVATION ANALYSIS. Harrison, S. H. (National Bureau of Standards, Washington, DC); LaFleur, P. D.; Zoller, W. H. Anal. Chem.; 47: No. 9, 1685-1688(Aug 1975).

Water is preconcentrated by freeze drying using a method which virtually eliminates sample contamination and trace element losses. To test the possibility of losses of volatile elements during the drying process, known quantities of radioactive tracers for 21 elements were added to water, the solutions freeze dried, and the tracer residues counted. The results confirm that at least 95 percent of all but the most volatile elements studied (Hg and I) were retained in the residue. The problem of transferring quantitatively the dry residue from the freeze drying container to an irradiation container was eliminated by designing a freeze drying container that would also serve as an irradiation and counting container. (LK)

16728 DETERMINATION OF PROTEIN-BOUND TRACE ELEMENTS IN BIOLOGICAL MATERIAL BY GEL FILTRATION AND NEUTRON ACTIVATION ANALYSIS. Norheim, G. (Univ. of Oslo); Steinnes, E. Anal. Chem.; 47: No. 9, 1688-1690(Aug 1975).

A method involving isolation of liver proteins followed by fractionation using gel filtration and subsequent determination of the elements Zr, Cd, Hg, Cu, As, and Se in the individual elution fractions by neutron activation is described. (LK)

16729 SOURCE IDENTIFICATION OF OIL SPILLS BY PATTERN RECOGNITION ANALYSIS OF NATURAL ELEMENTAL COMPOSITION. Duewer, D. L. (Univ. of Washington, Seattle); Kowalski, B. R.; Schatzki, T. F. Anal. Chem.; 47: No. 9, 1573-1583(Aug 1975).

Pattern recognition techniques are applied to the problem of determining the source of an oil spill, using its elemental composition as analyzed by neutron activation analysis, when the field sample has undergone weathering. The utility of various elements for making this determination is assessed. Classification procedures using comparisons of the field sample to single ("point") known source samples and to multiple ("fuzzy") artificially weathered source samples of a given type are presented and discussed. A technique of the latter form is recommended as a superior tool for the solution of this problem, and others of similar nature. (auth)

16730 DETERMINATION OF IODINE-129 AT NATURAL LEVELS USING NEUTRON ACTIVATION AND ISOTOPIC SEPARATION. Rook, H. L.; Suddueth, J. E.; Becker, D. A. (National Bureau of Standards, Washington, DC). Anal. Chem.; 47: No. 9, 1557-1562(Aug 1975).

Iodine-129 levels have been published for biological matrices that naturally accumulate iodine such as animal thyroid and kelp. However, published procedures have insufficient sensitivity to determine ^{129}I in other environmental and biological species. A unique procedure has been developed for the determination of ^{129}I which couples neutron activation with mass separation. The procedure results in a significant improvement in sensitivity, thus allowing analyses to be performed on a variety of matrices which heretofore had not been investigated. Method development and analytical procedures are presented and analytical results at the 10^{-13}-10^{-14} gram ^{129}I level are given. (auth)

16731 SIMULTANEOUS DETERMINATION OF TELLURIUM AND URANIUM BY NEUTRON ACTIVATION ANALYSIS. Gladney, E. S.; Rook, H. L. (National Bureau of Standards, Washington, DC). Anal. Chem.; 47: No. 9, 1554-1557(Aug 1975).

A procedure for the simultaneous determination of tellurium and uranium is described. The procedure utilizes thermal neutron activation, followed by sample combustion and a gas phase separation of the volatile radionuclides of interest. This method is sensitive enough to permit the measurement of tellurium and uranium at their naturally occurring levels in materials of biological and environmental origin. The procedure has been successfully employed to determine the tellurium and uranium concentrations in three Standard Reference Materials (SRMs) currently being offered by the National Bureau of Standards, and in atmospheric particulate material collected in rural Maryland. (auth)

16732 REVIEW OF BROMINE DETERMINATION IN FOODS. Getzendaner, M. E. (Dow Chemical Co., Midland, MI). J. Assoc. Off. Anal. Chem.; 58: No. 4, 711-716(Jul 1975).

Organic compounds containing bromine, including methyl bromide, ethylene dibromide, and 1,2-dibromo-3-chloropropane, are used extensively for the fumigation of foods, or soils in which foods grow, making it necessary to determine residues of bromine and bromine-containing organic compounds. A large number of methods for the determination of bromine in foods, as organic, inorganic, and combined total bromide, have been developed. In methods for organic bromide, the bromine is converted to the inorganic form for measurement by titration, photometry, or other means. In recent years, instrumental methods have been developed in which the total bromine in the sample is determined, regardless of the state in which it exists. X-ray fluorescence and neutron activation analysis are the 2 instrumental methods used most widely. Residue data are presented for some typical bromine-containing samples. (auth)

16733 DETERMINATION OF TUNGSTEN IN GEOLOGIC MATERIALS BY NEUTRON ACTIVATION ANALYSIS. Simon, F. O.; Rollinson, C. L. J. Res. U.S. Geol. Surv.; 3: No. 4, 475-478 (1975).

A method is described for the determination of tungsten in geologic materials. After fusion with sodium peroxide, tungsten

is isolated by extraction into chloroform with alpha-benzoinoxime, back extraction into aqueous potassium hydroxide, and precipitation with alpha-benzoinoxime. The activities of the 0.13- and 0.48-MeV gamma rays are measured. The activity of the 0.155-MeV gamma ray of ^{188}Re (^{188}W), added prior to the fusion, is measured to determine the yield; yields normally range from 40 to 90 percent. The coefficients of variation for less than part-per-million concentrations of tungsten are normally less than 20 percent; the limit of detection is 0.005 ppM for a 100-mg sample. (auth)

16734 INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF KCl AND KI. Damburg, N. A.; Veveris, O. E.; Mikelson, G. G. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 2, 3-7(1975). (In Russian).

Impurities are determined by instrumental activation analysis using a Ge(Li)-detector and short- and long-lived isotopes. The thresholds of detection and the contamination of elements: Br, I, Na, Fe, Co, Zn, Rb, and Sb, were measured. Activation with resonance neutrons is found to improve the conditions for the determination of Br and I. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 16915 and 17278.

16735 (BNWL-1950(Pt. 4), pp 23-24) CHEMICAL AND MOLECULAR COMPOSITION TECHNOLOGY. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Freon was analyzed from samples collected in St. Louis, Missouri, and Quillayute, Washington, for use as a conservative tracer. In addition, a procedure using the complexation of a metal ion was developed which allows its detection by gas chromatography. Selenium in seawater has been measured in this manner and technique development is underway for complexes of Be, Cr, and Al. (auth)

16736 (DP-1386) VOLUMETRIC DETERMINATION OF HYDROXIDE, ALUMINATE, AND CARBONATE IN ALKALINE SOLUTIONS OF NUCLEAR WASTE. Baumann, E. W. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jun 1975. Contract AT(07-2)-1. 12p. Dep. NTIS $4.00.

An integrated procedure was developed for determining OH^-, $Al(OH)_4^-$, and $CO_3^{=}$ in alkaline nuclear waste. The free alkali, the hydroxide released when $Al(OH)_3$ is complexed with oxalate, and the precipitated $BaCO_3$ were determined by acidimetric titration. With a 50-mu l sample, the relative standard deviations were 1 to 2 percent for nonradioactive test solutions and 2 to 5 percent for radioactive process solutions. (auth)

16737 (NBL-276) LABORATORY QUALITY ASSURANCE PROGRAM FOR URANIUM ASSAY. Pietri, C. E.; Jacob, E. H.; Bracey, J. T. (Energy Research and Development Administration, New Brunswick, N. J. (USA). New Brunswick, Lab.). June 1975. 21p. Dep. NTIS $4.00.

The quality assurance program used at the New Brunswick Laboratory (NBL) to assure the reliability of the analytical results obtained from the determination of uranium in solution by the NBL titrimetric method is described. Statistical data generated from this program are presented. (auth)

16738 (NIM-1722) DETERMINATION OF SMALL AMOUNTS OF FLUORIDE IN URANIUM COMPOUNDS BY USE OF AN ION-SELECTIVE ELECTRODE. Laboratory Method No. 9/13. Shelton, B. J. (National Inst. for Metallurgy, Johannesburg (South Africa)). 2 May 1975. 7p. Dep. NTIS (US Sales Only) $4.00.

A method is presented for the determination of fluoride in uranium metal and oxide at levels from 16 ppM upwards. Uranium is separated from fluoride by extraction into a solution of di(2-ethylhexyl)-phosphoric acid (HDEHP) in carbon tetrachloride. The fluoride remaining in the aqueous phase is determined by potentiometric measurement with an ion-selective electrode. A correction is made for the fluoride lost during the dissolution or extraction step, or both, which is based on a determination of the apparent loss of fluoride on spiked samples that are taken through the whole procedure. (auth)

16739 (SAND-75-0014) MANUAL OF ANALYTICAL METHODS FOR THE ENVIRONMENTAL HEALTH LABORATORY. Gray, C. E. (comp. and ed.). (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1975. Contract AT(29-1)-789. 180p. Dep. NTIS $4.00.

The manual contains four sections: absorption spectrophotometry; general radiochemical procedures; instrumental analysis; and calibration of field instruments. Included in the individual analyses using absorption spectrophotometry is one for total iodine in oil. Radiochemical procedures are given for: actinides in urine and water; ^{137}Cs in soil and vegetation; ^{137}Cs in soil, urine, vegetation, and water; enriched uranium in urine; gross beta activity in soil, urine, vegetation, and water; plutonium in urine and soil; ^{210}Po in urine and water; ^{24}Na in air, blood, urine, and water; ^{90}Sr in soil, vegetation, and water; tritium in urine, water, and on swipes; and total uranium on fallout trays and in soil, urine, and water. Among the individual instrumental analyses is a spectrographic method for determining beryllium in air samples and swipes. (LK)

16740 SPECTROPHOTOMETRIC DETERMINATION OF MOLYBDENUM AS A MIXED THIOCYANATE-MONOCTYL α-ANILINOBENZYLPHOSPHONATE COMPLEX. Tamhina, B.; Herak, M. J.; Jagodic, V. (Univ., Zagreb). Anal. Chim. Acta; 76: No. 2, 417-422(Jun 1975).

A sensitive method for the spectrophotometric determination of molybdenum is described. Molybdenum is reduced with ascorbic acid in hydrochloric acid solution, and complexed with thiocyanate ions, and the complex formed is extracted with monooctyl α-anilinobenzylphosphonate (MOABP) in chloroform. The molar absorptivity of the method is 5858 l mole^{-1} cm^{-1} at 470 nm. Beer's law is obeyed in the range 0.7 to 28 μg Mo ml^{-1}. Few metals interfere; the separation of the interfering elements is discussed. The composition of the extracted complex is $Mo(SCN)_5 \cdot 3$ MOABP. (NL)

16741 SOLID-STATE LUMINESCENCE DETERMINATION OF TRACES OF BERYLLIUM WITH DINAPHTHOYLMETHANE. Ryan, D. E.; Granda, M.; Janmohammed, M. (Dalhouise Univ., Halifax, Nova Scotia, Canada). Anal. Chim. Acta; 76: No. 2, 467-470(Jun 1975).

16742 NEW APPLICATION OF LANDOLT-TYPE REACTIONS. The Determination of Molybdenum, Copper, and Vanadium. Weisz, H.; Pantel, S. (Univ., Freiburg i. B.). Anal. Chim. Acta; 76: No. 2, 484-490(Jun 1975).

16743 RAPID METHOD OF TRACE ANALYSIS OF URANIUM (IV) FROM PHOSPHORITES. Dubey, R. K.; Agrawal, Y. K. (Indian Inst. of Tech., Bombay). Chem. Geol.; 15: No. 3, 223-227(May 1975).

A new spectrophotometric method for the microdetermination of uranium (VI) from phosphorites in the presence of commonly occurring metal ions has been developed. Uranium is extracted from chloroform solution of N-phenyl-2-naphtho-hydroxamic acid (N-P-2-NHA) at pH 4.0 to 4.5. The orange-red extract has the maximum absorption at 515 nm. The extraction was quantitative and obeys Beer's law at 515 nm. (NL)

16744 USE OF A DEMOUNTABLE HOLLOW-CATHODE LAMP SOURCE AND A PIEZOELECTRICALLY SCANNED FABRY-PEROT INTERFEROMETER FOR INVESTIGATION OF THE ISOTOPIC COMPOSITION OF LEAD ORES. Bevan, D. G.; Kirkbright, G. F. (Imperial Coll. of Science and Tech., London). Anal. Chim. Acta; 76: No. 2, 361-370(Jun 1975).

The intensities of the hyperfine and isotope components of the Pb 405.8-nm atomic line emission from a demountable hollow-cathode discharge lamp have been measured with a piezoelectric scanning Fabry-Perot interferometer. A simple method has been developed for the determination of the isotopic composition of lead ores and minerals. Lead is separated by a sequential cathodic and anodic electrodeposition procedure with platinum electrodes and the foil electrode bearing the final deposit of lead dioxide is used as the spectroscopic electrode (cathode) within the demountable hollow-cathode lamp. The method has been applied successfully to a number of ore and mineral samples. (INIS)

16745 DETERMINATION OF RUTHENIUM AND IRIDIUM IN ANODE COATINGS BY ATOMIC-ABSORPTION SPECTROSCOPY. Harrington, D. E.; Bramstedt, W. R. (Diamond Shamrock Corp., Painesville, OH). Talanta; 22: No. 4-5, 411-415(Apr 1975).

A method is described for the determination of ruthenium and iridium coated on an electrode surface. The coating is chemically removed from the electrode by fusion with alkali, and the resulting solution prepared for analysis. Interelement interferences are eliminated by using a titanium-potassium matrix solution as a releasing agent. Recovery and precision data are given for ruthenium and iridium. The atomic absorption spectroscopy determination of ruthenium compares favorably with a standard colorimetric method. (auth)

16746 SUB-MICROGRAM PER GRAM CONCENTRATIONS OF MERCURY IN ORCHARD LEAVES DETERMINED BY ISOTOPE DILUTION AND SPARK-SOURCE MASS SPECTROMETRY. Alvarez, A. (National Bureau of Standards, Washington, DC). Anal. Chim. Acta; 73: No. 1, 33-38(Nov 1974).

A stable isotope dilution procedure in conjunction with the spark source mass spectrograph was developed for determining sub-$\mu g\ g^{-1}$ concentrations of mercury in orchard leaves. A 5-g sample was spiked with a solution of mercury, isotopically enriched in ^{201}Hg and ^{199}Hg. The ^{198}Hg served as a carrier. After wet-ashing the sample with nitric and perchloric acids under reflux and distilling most of the acid, the isotopically equilibrated mercury was electrodeposited onto high-purity gold wires for sparking in the mass spectrograph. The concentration was calculated from the altered isotope ratio, $^{201}Hg/^{202}Hg$, and other data. The results were compared with those obtained by atomic absorption spectrometry and neutron activation, leading to a certified value of $0.155 \pm 0.015\ \mu g\ g^{-1}$ for the mercury content of Orchard Leaves, SRM 1571 of the National Bureau of Standards. (auth)

16747 SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN ULTRAPURE TUNGSTEN AND TUNGSTEN OXIDE. Harizanov, Y.; Jordanov, N. (Bylgarska Akademiya Naukite, Sofia). Talanta; 22: No. 4-5, 485-488(Apr 1975).

The effects of an external magnetic field and of the diameter of the anode on the spectroscopic line intensity of the impurity elements in ultrapure tungsten and tungsten oxide were studied. The results obtained are used for the development of a more sensitive method for the determination of these impurities (Mn, Pb, Fe, Ni, Al, Mo, V, Cu, Cr). (auth)

16748 DIRECT GRAVIMETRIC DETERMINATION OF MOLYBDENUM(VI) IN PRESENCE OF OTHER IONS AND ITS APPLICATIONS TO ALLOY STEEL. Chattopadhyay, S.; Pal, B. K.; Mitra, B. K. (Jadavpur Univ., Calcutta). Talanta; 22: No. 4-5, 431-435(Apr 1975).

N-o-Toluoyl-N-o-tolylhydroxylamine was synthesized and employed successfully as a gravimetric reagent for direct determination of molybdenum(VI). The dried complex (110 to 120°C) has definite composition, $MoO_2(C_{15}H_{14}O_2N)_2$. The method is quite simple, rapid, sensitive and gives reproducible results. The precipitation is quantitative at room temperature over a wide range of acidity. The reagent is highly selective and the method is satisfactory for analyzing alloy steels. (auth)

16749 KINETIC DETERMINATION OF THORIUM, VANADIUM, AND IODIDE WITH THE USE OF A POTENTIOSTAT. Weisz, H.; Rothmaier, K.; Ludwig, H. (Univ., Freiburg i. B.). Anal. Chim. Acta; 73: No. 1, 224-228(1974).

A method is described for the determination of thorium, based on its catalytic action on the oxidation of iodide with hydrogen peroxide, and the determination of vanadium, based on the oxidation of iodide with bromate. The catalytic action of iodide on the cerium(IV–arsenic(III) reaction can also be utilized in the proposed technique. Kinetic–catalytic determination by the potentiostatic method is suitable for thorium in the range 30 to 250 μg/50 ml, vanadium in the range 1 to 10 μg/50 ml, and iodide in the range 0.3 to 3.0 μg/50 ml. (auth)

16750 ATOMIC ABSORPTION SPECTROMETRY OF THE LANTHANIDES IN MINERALS AND ORES. Doghe, W.; Verbeek, F. (Ghent Rijksuniversiteit). Anal. Chim. Acta; 73: No. 1, 87-95(Nov 1974).

A method is described for a rapid, sensitive, accurate, and precise determination of 12 lanthanides and yttrium by atomic absorption spectroscopy. In most analyses the standard addition technique was used to eliminate chemical, ionization and matrix interferences. For samples of similar origin, a procedure with a comparison standard was developed; this proved to be very suitable for routine analyses. The lanthanides and yttrium were determined in bastnasite, monazite, and gadolinite. The analyses were performed on solutions containing a maximum sample concentration of 30 g l^{-1} in 80% of methanol and buffered with alkali ions. The accuracy of the method was checked by independent procedures such as gravimetry, pulse polarography, and flame emission spectrophotometry. (auth)

16751 FAST DETERMINATION OF THE NO_3/U RATIO IN SUBSTOICHIOMETRIC URANIUM NITRATE SOLUTIONS. Slanina, J.; Lingerak, W. A. (Stichting Reactor Centrum Nederland, Petten). Z. Anal. Chem.; 274: No. 2, 115-117(1975).

1 fig.; 2 tabs.; 9 refs.

A fast determination of the nitrate/uranium ratio in substoichometric uranyl nitrate solutions is proposed. As the absorption of the uranyl nitrate solution at a wave length of 412 nm is strongly dependent on the NO_3/U ratio (if this ratio is below 2.00), the amount of nitrate needed to reach a NO_3/U ratio of 2.00 can be determined by a spectrophotometric titration. Afterwards the uranium concentration is determined by spectrophotometry at 412 nm and the NO_3/U ratio can be calculated. The reproducibility of the method is 0.7%, the accuracy is 1.8%. One determination takes 10 min. (auth)

16752 SUCCESSIVE DETERMINATION OF POTASSIUM AND CALCIUM BY ISOTOPE DILUTION MASS SPECTROMETRY. Murozumi, M.; Nakamura, S. (Muroran Inst. of Tech., Hokkaido (Japan)). Jap. Anal.; 23: No. 8, 912-916(Aug 1974). (In Japanese).

Isotope dilution mass spectrometry using double spikes (^{41}K and ^{42}Ca) can be applied to the successive determination of minute amounts of potassium and calcium. The detection limit of the present method is 10^{-13} g for potassium and 10^{-10} g for calcium, while the coefficients of variation for the measurements of $^{41}K^+/^{39}K^+$ and $^{42}Ca^+/^{40}Ca^+$ are 0.10 to 0.97% and 0.22 to 0.86%, respectively. Potassium contained in the ^{42}Ca spike solution and calcium in the ^{41}K spike solution are the inevitable source of error. The range of error is scattered over a somewhat wide range, 0.02 to 2.04% for potassium and 0.19 to 6.41% for calcium, depending on the measured values and amounts of spikes added. This can be reduced to the minimum level through the correction, because induced contaminations by spike solutions are known. Another source of error is the isobar effect caused by overlapping of the $^{40}K^+$ ion beam onto the $^{40}Ca^+$ ion beam. The overlapping degree is estimated from the ion beam intensity of $^{39}K^+$. Baking treatment decreases $^{40}K^+$ to only 10^{-4} of $^{40}Ca^+$ in the ion beam intensity, and the former is said to give no effects to the determination of the latter. The present method requiring less amount of the sample than any other methods has opened a way to the geochemistry of ice core samples from both polar snow strata. (auth)

16753 EXTRACTION WITH BENZOYLACETONE-CHLOROFORM AND SPECTROPHOTOMETRIC DETERMINATION OF BERYLLIUM USING THE COLORATION OF PERTITANIC ACID. Matsubara, C. (Tokyo Coll. of Pharmacy (Japan)). Jap. Anal.; 23: No. 8, 878-883(Aug 1974). (In Japanese).

The Ti(IV)-H_2O_2 reagent has been used for the determination of Be(II) in alloy and ores. The reagent is an aqueous mixture of sodium fluorotitanate, sodium fluoride and hydrogen peroxide in a molar ratio of 1 : 4 : 1. Beryllium(II) reacts with the reagent and forms a tetrafluoroberyllium(II) complex and pertitanic acid. The latter product exhibits an absorption maximum at 420 nm. Because of the higher stability of the tetrafluoroberyllium(II) complex as compared to a hexafluorotitanium(IV) complex, Be(II) can be determined by measuring the absorbance of pertitanic acid. Since Al(III), Si(IV), Fe(III), etc. interfere with the complex formation of Be(II), the extraction of Be(II) with chloroform was examined, and a procedure was developed for the determination of Be(II) in materials containing such elements. The use of benzoylacetone as a chelating agent for Be(II) is preferable to acetylacetone. The addition of EDTA as a masking agent for Al(III) and Fe(III) has no effect on the formation of pertitanic acid in 2 N HCl solution. The analytical processes presented above were applied to the determination of Be(II) in Be–Cu alloy, beryl and crysoberyl with good results. (LK)

16754 COLLABORATIVE STUDY OF THE ELEMENTAL ANALYSIS OF PLANT TISSUE BY DIRECT READING EMISSION SPECTROSCOPY. Jones, J. B. Jr. (Univ. of Georgia, Athens). J. Assoc. Off. Anal. Chem.; 58: No. 4, 764-769(Jul 1975).

Eleven laboratories collaboratively studied the use of direct reading emission spectroscopy, with the solution rotating disk technique of excitation for the elemental analysis of plant tissues; aluminum, barium, boron, calcium, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, sodium, strontium, and zinc in alfalfa, citrus leaves, orchard leaves, pine needles, and tomato leaves. Since not all direct reading emission spectrographs are alike in all features, provisions were made to accommodate these differences relating to sample preparation, selection of the internal standard, and method of sample excitation. The sample is dry ashed and the ash is dissolved in an acidic buffer solution. Coefficients of variation obtained in the collaborative study ranged from 3 to 50 percent. For most plant tissue samples and elements, the value is less than 20 percent. The results obtained with direct readers are generally better than those obtained on photographic instruments and comparable to those obtained by atomic absorption spectroscopy. Direct reading emission spectroscopy is rapid, providing 14 elemental analyses in generally less than 1 min for a prepared sample. The method has been adopted as official first action. (auth)

16755 RADIOFREQUENCY CAVITY ION SOURCE IN SOLIDS MASS SPECTROMETRY. Donohue, D. L.; Harrison, W. W. (Univ. of Virginia, Charlottesville). Anal. Chem.; 47: No. 9, 1528-1531(Aug 1975).

A radiofrequency discharge in argon is used to sputter and ionize solid samples for analysis. Metals machined to act as a cavity electrode can be analyzed directly. Samples may also be deposited from solution for subsequent elemental analysis of the residues. The rf discharge allows analysis of both conductors and nonconductors. A glass electrode is used as a cavity electrode for application of multielement solutions. The precision obtainable by

electrical scans was about 10 percent RSD. Lowest detection limit is approximately 10 to 100 ng. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 17189, 17194, 17196, 17565, and 17675.

16756 (BNWL-1950(Pt. 4), pp 2-11) LOW-LEVEL RADIOLOGICAL CHEMISTRY LABORATORY TECHNIQUES. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Newly developed electronic and computer technology together with improved low-background construction materials have aided in developing more sensitive radiation instrumentation. Backgrounds have been reduced by tenfold at the Th and U photopeak areas, as well as twenty- to one-hundredfold in the ^{40}K photopeak region. The employment of pulse pileup rejection systems on Ge(Li) and Si(Li) spectrometers has allowed count rates with system dead time of 40% to be used with less than a 2% live-time loss. High sensitivity x-ray analysis, coupled with computer techniques, allowed measurements of specific tracers for resuspension studies. A feasibility study of laser excitation fluorescence and ionization analysis was completed, along with a study of the techniques required for the measurement of long half-life species from power reactors, such as ^{129}I, $^{59-61}Ni$, $^{93}Zr/Nb$, ^{99}Tc, ^{75}Se, ^{135}Cs, and ^{151}Sm. (auth)

16757 (CONF-7410123-, pp 4.25-4.34) MEASUREMENT OF HYDROGEN DISTRIBUTIONS BY NEUTRON RADIOGRAPHY. Zeilinger, A.; Rauch, H. (Atominstitut, Vienna). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Experiments were made using neutron radiography as a tool for the investigation of hydrogen distribution and the detection of hydrogen. These experiments are reviewed. Neutron radiography can be used for hydrogen detection under various circumstances. Therefore, metal adhesives and O-rings in vacuum apparatuses can be inspected. An application to physical problems is the possibility of measuring the diffusion of hydrogen in different media, so much experimental work was done on the H_2O–D_2O diffusion process. The results agree quite well with previous measurements. They show a rather concentration-dependent diffusion coefficient. Measurements on CH_3OH–CD_3OD and on CH_3OD–CD_3OD indicate that the methanol molecule diffuses as a whole. At present, experiments on the H_2–D_2 diffusion, on hydrogen diffusion in metals, and on water diffusion in concrete are under progress. (auth)

16758 (ORNL-TM-4924) MEASUREMENT OF RADON PROGENY CONCENTRATIONS IN AIR BY ALPHA-PARTICLE SPECTROMETRY. Kerr, G. D. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 30p. Dep. NTIS $4.50.

A technique is presented for measuring air concentrations of the short-lived progeny of radon-222 by the use of alpha spectrometry. In this technique, the concentration of RaA, RaB, and RaC are calculated from one integral count of the RaA and two integral counts of the RaC' alpha-particle activity collected on a filter with an air sampling device. The influence of air sampling and counting intervals of time on the accuracy of the calculated concentrations is discussed in the report. A computer program is presented for use with this technique. It is written in the BASIC language. The program will calculate the air concentrations of RaA, RaB, and RaC, and will estimate the accuracy in these calculated concentrations. (auth)

16759 ANALYTICAL USE OF ION-INDUCED X RAYS. Folkmann, F. (Niels Bohr Institutet, Copenhagen). J. Phys., E (London); 8: No. 6, 429-444(Jun 1975).

Measuring the x ray emission induced by energetic protons and α particles from accelerators has become a valuable tool for studying trace amounts of most elements, and is especially suited for small samples. Typical parameter ranges are ion energies of 0.1 to 10 MeV/u, concentrations down to 10^{-6} to 10^{-7} by weight, absolute amounts down to 10^{-9} to 10^{-12} g, trace elements of $Z > 13$. The technique is described, and is based on the use of solid state x-ray detectors. Use of heavy ions, microbeams, and surface analysis are all considered. Advantages and limitations of the technique are discussed, and comparison is made with x-ray emission generated by photons and electrons. Fields of application are reviewed. (auth)

16760 DETERMINATION OF POTASSIUM CONTENT AND BETA ACTIVITY IN BIOLOGICAL SAMPLES TAKEN FROM THE NUCLEAR POWER PLANT IN NORTH TAIWAN. Wu, T. Y. (Atomic Energy Council, Taipei, Taiwan); Ma, I.; Kao, L. Y. Nucl. Sci. J. (Taiwan); 12: No. 1, 42-47(Mar 1975). (In Chinese).

The determination of potassium content and beta activity in the biological samples taken from the nuclear power plant in North Taiwan is described. The fresh sample was incinerated in an electric furnace. Then the inorganic elements in the ash sample were extracted with 2N hot HCl solution. The filtrate was made basic solution with 6N NaOH at boiling. The hydroxide precipitate was filtered with filter paper to discard. Then the filtrate at ice cooling temperature was added 3% sodium tetraphenylborate solution until the white precipitate of potassium tetraphenylborate was completed. The precipitate was filtered with glass filter (1G4), then dried and weighed. The potassium content and beta activity of ^{40}K in the sample were calculated. The gross beta activity of the ash sample was measured with a low background GM counter. Finally, the net activity of the sample was obtained by subtracting the ^{40}K activity from the gross beta activity. (auth)

16761 ALPHA SPECTROMETRIC INVESTIGATION OF URANIUM HEXAFLUORIDE. I. Koske, P. (Uran-Isotopentrennungs-g.m.b.H., Juelich, Ger.); Nentwig, P.; Dreizler, H.; Gaide, W. J. Br. Nucl. Energy Soc.; 14: No. 2, 157-158(Apr 1975).

The purpose of the investigation was to use α ray activity of ^{234}U, in order to determine its content in a sample. A spectrometric investigation was carried out on a thin layer, 0.009 mg/cm^2 thick, of UF_6, prepared by freezing the particles directly from the gaseous phase onto a target cooled with liquid air. Measurements were made with a partially depleted semi-conductor detector, an amplifying system, and a multi channel analyzing system. Physical contact between detector and sample had to be avoided to prevent chemical reaction of the detector material with HF produced by hydrolysis of the UF_6. Spectra were evaluated by different calculation methods. The main problem in evaluation was created by low-energy tailing of the peaks due to absorption of the α particles within the layer. The method suggests some promising results for the investigation of minor isotope contents, i.e., the $^{234}U/^{238}U$ ratio. (UK)

16762 ISOTOPE DILUTION METHOD FOR DETERMINATION OF SULFUR ON AUTOMOTIVE EXHAUST GAS CATALYSTS. Mayer, W. J.; Lechman, D. C.; Beyerlein, D. G. (General Motors Corp., Warren, MI). Int. J. Appl. Radiat. Isot.; 26: No. 5, 233-236(May 1975).

Fuel-air mixtures and engine oils contain sulfur that can deposit on exhaust gas catalysts and reduce catalytic efficiency. The fraction of sulfur that originates from each source can be calculated from the sulfur concentration of the fuel, air and oil, and their respective consumption rates. Such methods for obtaining the required data are, however, cumbersome and difficult to carry out with acceptable reliability; thus a more precise method for determining the percentage sulfur deposited from these sources was required. An isotope dilution method, which employs benzyl disulfide tagged with ^{35}S, was devised for this analysis. Four hundred microcuries of tagged benzyl disulfide was dissolved in engine oil and used in an operating engine. Catalyst samples were then analyzed periodically during engine operation for total and radioactive sulfur. From the specific activity of engine oil and catalyst samples, the percent sulfur deposited on the catalyst from the oil and fuel-air mixture was calculated. The data indicate that between 8 and 12% of the sulfur originated from the engine oil. The standard deviation of the method was approximately 10%. (auth)

16763 POSSIBILITY OF MONITORING THE ASH OF COAL FROM THE GAMMA RADIATION EMITTED BY NON-ELASTIC FAST-NEUTRON SCATTERING. Starchik, L. P. Coke Chem., USSR (Engl. Transl.); No. 5, 52-54(1974).

A close correlation exists between the carbon content and ash of coals. A procedure is thus proposed for monitoring ash by recording the γ radiation emitted by the nonelastic scattering of fast neutrons by carbon nuclei. A linear relationship has been obtained between the γ count rate in the 4.43 MeV range and the ash of the coal, in the range 5 to 50%. (auth)

16764 EXPRESS ASH ANALYZER BASED ON THE RECORDING OF FORWARD-SCATTERED GAMMA RAYS. Vasilev, A. G. Coke Chem., USSR (Engl. Transl.); No. 5, 50-52(1974).

An ash analyzer was developed which is based on the monitoring of forward-scattered γ rays from ^{241}Am. A value can be obtained for an unprepared coal sample within less than 5 min. The value is almost unaffected by variations in moisture content, bulk density, and size of sample. Errors are of the order of 0.1% absolute with coke-oven charge and individual coals and 0.33% absolute with run-of-plant charge. (auth)

16765 RAPID SEPARATION AND DETERMINATION OF RADIONUCLIDES IN FOODS. Boppel, B. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp

273-291 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

A rapid ashing method was described with which relatively large amounts of foods (about 500 g) can be ashed in the relatively short time of approximately an hour. Temperature measurements in the material during the ashing process were made and the volatility rate of ^{137}Cs was determined as a function of the effective temperature in the sample. A chemical separation procedure, principally liquid-liquid extraction, rapidly separates the radionuclides to be determined into single or group fractions on which radioactivity measurements can be made. (tr-auth)

16766 CONCENTRATIONS AND CHEMICAL ANALYSIS OF RARE EARTH ELEMENTS IN VARIOUS SAMPLES. Takada, K.; Hirokawa, K. (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals). J. Jap. Inst. Metals; 38: No. 7, 654-658(Jul 1974). (In Japanese).

Determination of rare earth elements in various samples by the x-ray fluorescence method and those of impurity levels in high pure rare earths by the d.c. arc, emission spectrographic method have been studied. In the x-ray fluorescence method, rare earth elements were precipitated as fluoride. Compared with the rare earth oxide, the rare earth fluoride precipitate absorbed little moisture and carbon dioxide in atmosphere. Detection limits of rare earth elements were extended by this fluoride procedure because of no dilution with the fusing agent. Detection limits for Y(YKα) and Yb(YbLα_1) were about 5 μg, for Ce(CeLβ_1) and Gd(GdLα_1) about 20 μg, and those elements of about 50 μg were analyzed with the coefficient of variation less than 2%, respectively. Many reports have been published for the chemical analysis of high-purity rare earths by the d.c. arc emission method. Most of those reports were concerned with the determination of impurity rare earths in pure rare earths (e.g. Y, La, Eu, Yb, etc.) which gave simple spectra with rather less lines and low background. The satisfactory results were obtained by d.c. arc emission for 10 ppM Eu in Yb and for 10 ppM Y in La. On the other hand, few have been reported on the determination of high purity rare earths (e.g. Ce, Pr, Nd, Sm, etc.) with multi-component emission spectral lines of strong intensity and high background. Therefore, the determination of 10 ~ 500 ppM Y_2O_3 in Sm_2O_3 was investigated by the d.c. arc emission spectrographic method. Yttrium was separated from samarium as double salt with saturated sodium sulfate solution. The determination of trace yttrium in high-purity Sm_2O_3 became possible by the separation procedure. The best yttrium spectrum line for determination in the range of 3100 to 4700 Å was Y II 3633.123 Å and other lines could not be employed because of weak line intensity and high interference by samarium spectra. By the method proposed, trace amounts of Y_2O_3 in Sm_2O_3 were determined, and the coefficient of variation of sample containing 108 ppM Y_2O_3 in Sm_2O_3 was about 10%. (auth)

16767 PRELIMINARY RESULTS FROM PROTON INDUCED TRACE ELEMENTAL ANALYSIS IN LIVER SAMPLES. Kubo, H.; Hashimoto, S. (Kitasato Univ., Kanagawa (Japan). School of Medicine); Chiba, R.; Yokota, H. Kitasato Igaku.; 4: No. 4, 250-254(Aug 1974). (In Japanese).

Biological samples were taken through autopsy from three patients diagnosed as having cardiac disease hepatitis and hepatoma with liver cirrhosis. The data were obtained by x-ray fluorescence induced by 1.3 and 3.7 MeV proton beams delivered from a 4 MeV Van de Graaff accelerator at the Tokyo Institute of Technology. The results presented in this report are only preliminary. Differences in the relative amounts of trace elements were observed among these liver samples. (auth)

16768 SEMIAUTOMATED SYSTEM FOR THE PRODUCTION AND ANALYSIS OF SUCROSE DENSITY GRADIENTS. Lange, C. S.; Liberman, D. F. (Univ. of Rochester, NY). Anal. Biochem.; 59: 129-145(1974).

A semiautomated system in DNA damage studies permitting considerable accuracy, speed, and reproducibility in the making and fractionation of sucrose density gradients is described. The system consists of a modified Beckman gradient forming device that makes six gradients simultaneously and delivers them into six 12.5 ml polyallomer centrifuge tubes in such a manner that new material is continuously added to the meniscus of the gradient. The gradients are fractionated three at a time and up to 100 fractions per gradient can be collected automatically directly into scintillation vials with a choice of drop counting or time mode with rinse and automatic addition of scintillation fluid to each vial. The system can process up to six gradients per hour but centrifugation time is usually the limiting factor. With neutral sucrose gradients, sharp, reproducible, monodisperse peaks containing up to 100 percent of the gradient radioactivity are usually obtained but a smaller monodisperse peak containing as little as 3.5 percent of the gradient radioactivity can be detected under conditions where some pairs of molecules might tangle or dimerize. The resolution and reproducibility of this system when used with neutral sucrose gradients is at least the equal if not superior to that commonly claimed for alkaline sucrose gradients. (auth)

16769 RADIOCHEMICAL DETERMINATION OF VERY LOW CONCENTRATIONS OF NICKEL IN ROCKS AND MINERALS. Zielinski, R. A. J. Res. U. S. Geol. Surv.; 3: No. 4, 467-473 (1975).

A radiochemical procedure has been developed for the determination of very low concentrations of nickel in rocks and minerals. Sensitivity is 0.01 mu g Ni. Accuracy and precision is estimated to be + -5 percent to levels as low as 0.1 mu g Ni--a marked improvement over other analytical techniques. Samples are irradiated, combined with nickel carrier, and treated by a series of chemical procedures: (1) collection of nickel in a lead bead using a fire-assay technique, (2) refusion of the lead bead and precipitation of basic element hydroxides, (3) anion-exchange chromatography, and (4) precipitation of nickel dimethylglyoxime. The nickel precipitate is weighed to determine chemical yield and counted for beta activity of ^{63}Ni along with a precipitate from irradiated nickel standard solution. (auth)

Separation Procedures

Refer also to abstract 16892.

16770 (BNWL-CC-558) CO-PRODUCT EXTRACTION STUDIES ON N-REACTOR PT-57 TARGET MATERIALS. Yunker, W. H.; Greenhalgh, W. O.; Lundquist, J. R.; Soine, T. S.; Harmon, K. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Apr 1966. Contract AT(45-1)-1830. 47p. Dep. NTIS $5.50.

Declassified 1 Jul 1975.

Single pellets (of approximately 70 g each) of irradiated lithium aluminate target from N-Reactor test PT-57 were used in a series of experiments to determine the extent to which the product tritium can be recovered by (a) vacuum outgassing of the target (thermal extraction-TX) and (b) in-vacuo chemical dissolution of the target in molten sodium tetraborate (flux extraction-FX). Five TX runs and seven FX runs were made. Thirty-five percent of the tritium was recovered in a form non-condensable at -196°C. The remainder was recovered in a condensable form (as T_2O, HTO, etc.). Post-extraction analysis of the melt from the seven flux extractions showed that a maximum of 2 percent of the original amount of tritium remained and that target dissolution was essentially complete in 12 hours. Flux extraction of two pellets which had been subjected to thermal extraction showed less than 0.4 percent of the original amount of tritium remaining. Within experimental accuracy (+-2 percent), the total amounts of tritium recovered in four of the runs were equivalent to each other and to the content calculated by post-irradiation activation analysis of the Zircaloy container. The deviations of all other runs, but one, could be attributed to known experimental causes. It is concluded that extraction was more than 95 percent complete, by both methods. (auth)

16771 (CONF-7410123-, pp 9.10-9.28) STUDIES ON SHORT-LIVFD FISSION PRODUCTS AT THE MAINZ TRIGA REACTOR. Trautmann, N. (Univ., Mainz). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif.(USA)).

Neutron-rich nuclei of medium mass number are produced by thermal-neutron-induced fission of heavy elements, e.g., ^{235}U, ^{239}Pu, and ^{249}Cf. Pulse irradiations lead to an enhancement of the ratio of short-lived activities to the accompanying longer-lived components. One approach for investigating the properties of short-lived nuclei consists in a combination of rapid chemical separations with higher-resolution gamma spectroscopy. This is demonstrated by the isolation of neutron-rich isotopes of niobium by sorption on glass and of ruthenium by solvent extraction. Other rapid separation procedures from aqueous solutions are briefly summarized and a few examples for their application in nuclear fission- and delayed neutron studies are given. Some experiments with an on-line mass separator of the ISOLDE-type, using chemical targets, are described. (auth)

16772 (IEA-338) USE OF EXTRACTION CHROMATOGRAPHY IN THE SEPARATION, CONCENTRATION, AND DETERMINATION OF METALS IN URANIUM. Study of the System Al_2O_3-tri-n-octylamine-HCl-UO_2Cl_2. dos Anjos de Jesus, G.; Abrao, A. (Instituto de Energia Atomica, Sao Paulo (Brazil)). May 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

A method is reported for the separation and pre-concentration of Cd, In, Ag, Au, Hg, Bi, Zn, Pb and Sn present as contaminants in uranium. The technique of extraction chromatography using tri-n-octylamine (TOA) as stationary phase and Al_2O_3 as support was used. Other supports were studied: celite, silica gel, active coal, asbestos, pumice stone, and teflon. Alumina was preferred and used previously treated with isopor (polystirene) before the fixation of amine. Metals were separated from uranium through percolation of UO_2Cl_2 – 0.5M HCl (70–200 gU/l) into the Al_2O_3–TOA. With the exception of lead (55% retention), all other elements were retained. Only silver suffered the interference of uranium, its fixation diminishing when solutions with more than 75 gU/l were percolated. Comparison with liquid–liquid extraction using TOA and the fixation of the same metals into Al_2O_3–TOA was made. This last system presents the advantages of small volume of extractant, more favorable phase ratio and even exploits the property of multistages, peculiar to the chromatographic columns. While Cd, Ag, Pb, Be and Hg are only partially extracted from UO_2Cl_2 – 0.5M HCl, they are quantitatively sorbed into the column. This was used conveniently for the pre-concentration, as was demonstrated by the retention of cadmium (1 mg) from 10 liters of 0.5M HCl into a 5 ml Al_2O_3–TOA column. The metals were eluted from the column and determined by atomic absorption spectrometry. Five tenths to 1.0M HNO_3 or 1M NH_4Cl + 1M NH_4OH were used for Cd and Zn, while 0.5M HNO_3–1M thiourea was used for the elution of Ag, Hg, Pb, Bi and Au. An efficient elutriant for Sn was not found, this metal exhibiting strong tendency of remaining into the column, even when the amine was completely removed with ethanol. (auth)

16773 PROCEEDINGS OF THE INTERNATIONAL SOLVENT EXTRACTION CONFERENCE, LYON, FRANCE, SEPTEMBER 8–14, 1974. Volume I. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974). 1016p. (CONF-740917-P1).

Fifty-one papers were presented at the conference and included in Volume 1. A separate abstract was prepared for two papers. Seven papers appeared previously in NSA. For abstracts of these papers see 32:54, 55, 58, 71, 200, 206, and 3117. (LK)

For abstracts of individual papers see: 16774 and 16775.

16774 MECHANISM OF CLUSTER COMPOUNDS EXTRACTION. Gorbanev, A. I.; Sergeev, V. P.; Dzevitskii, B. E.; Margulis, V. B. (Baikov Inst. of Metallurgy, Moscow). pp 19-33 of Proceedings of the International Solvent Extraction Conference. Vol. I. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P1.

A systematic study has been carried out on the extraction of platinum metals in the presence of tin dichloride from aqueous solutions of hydrochloric acid with tributyl phosphate and a number of oxygen-containing solvents belonging to basic classes of organic compounds. The formation of clusters via platinum metal-to-tin bonding and the transfer of these to an organic phase in the form of cluster anions ion-paired to oxonium cations is the basis of the process, as established by the concentration dependence measurements and spectral (optic and Mössbauer) evidence. The above scheme is adequate for all the platinum metals in general. The character of intermetallic bonds in the clusters is discussed. (auth)

16775 KINETICS OF URANIUM, PLUTONIUM, RUTHENIUM, AND ZIRCONIUM EXTRACTION WITH TRIBUTYLPHOSPHATE. Pushlenkov, M. F.; Shchepetilnikov, N. N.; Kuznetsov, G. I.; Kasimov, F. D.; Yasnovitskaya, A. L.; Yakovlev, G. N. (Inst. of Radium, Leningrad). pp 493-513 of Proceedings of the International Solvent Extraction Conference. Vol. I. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P1.

The kinetics of the centrifugal extraction of uranium, plutonium, ruthenium, zirconium and nitric acid with tributylphosphate have been investigated. An experimental technique has been developed for making these measurements. It has been established that the rate of uranium plutonium and nitric acid extraction is diffusion controlled. The period of mass transfer (98-99% of the equilibrium state) varies from 0.6-6 sec. The rate of ruthenium extraction is limited by slow chemical reactions in the aqueous phase. It is shown that the centrifugal extractor can be effectively used for uranium and plutonium extraction. In some cases the distribution ratios of the elements can be changed by taking into account the differences in the rate of their extraction. (auth)

16776 PROCEEDINGS OF THE INTERNATIONAL SOLVENT EXTRACTION CONFERENCE, LYON, FRANCE, SEPTEMBER 8–14, 1974. Volume 2. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974). 995p. (CONF-740917-P2).

Fifty-nine papers were presented at the conference and included in Volume 2. Separate abstracts were prepared for 4 papers. Fifteen papers appeared previously in NSA. For abstracts of these papers see 30:26174 and 32:62, 63, 64, 65, 66, 70, 74, 199, 202, 203, 204, 208, 3061, and 8482. (LK)

For abstracts of individual papers see: 16777–16780.

16777 EXTRACTION OF TRIVALENT TRANSPLUTONIUM ELEMENTS AND EUROPIUM BY A MIXTURE OF DI-2-ETHYLHEXYLORTHOPHOSPHORIC ACID AND PHOSPHORUS PENTOXIDE FROM STRONGLY ACID MEDIA. Mayasoedov, B. F.; Chmutova, M. K.; Kochetkova, H. E.; Pribylova, G. A. (Inst. of Geochemistry and Analytical Chemistry, Moscow). pp 1103-1108 of Proceedings of the International Solvent Extraction Conference. Vol. II. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P2.

The extraction of trivalent transplutonium elements and europium from solutions of inorganic acids by a mixture of di-2-ethylehexylorthophosphoric acid (D2EHPA) and P_2O_5 in cyclohexane was investigated. It was shown that the proposed mixture of reagents quantitatively extracts Am and Eu from solutions of acids of sufficiently high concentration. Large amounts of aluminum and ammonium nitrates, at D2EHPA and P_2O_5 concentrations equal to 0.3 M and 0.1 M respectively, do not interfere with extraction. The extractant exhibits low-selectivity with respect to trivalent transplutonium elements. (auth)

16778 THERMODYNAMIC ACTIVITY MODEL FOR A SINGLE LANTHANIDE NITRATE LIQUID–LIQUID EXTRACTION SYSTEM. O'Brien, W. G.; Bautista, R. G. (Iowa State Univ., Ames). pp 1399-1408 of Proceedings of the International Solvent Extraction Conference. Vol. II. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P2.

A thermodynamic model for a single component extraction system has been developed by making use of the thermodynamic activity of the various species, the stability constants of the inorganic complexes formed, and by defining the solvent extraction equilibrium constants. (LK)

16779 THERMODYNAMICS OF EXTRACTION OF SALTS WITH NOBLE GAS IONS. Krasnov, K. S.; Kasas, T. S.; Kuznetsov, V. S. (Inst. of Chemistry and Technology, Ivanova, USSR). pp 1409-1418 of Proceedings of the International Solvent Extraction Conference. Vol. II. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See Conf-740917-P2.

Results from investigating the thermodynamics of extraction of alkali metal halides and alkaline earth metal halide by isoamyl alcohol are presented. The distribution of salts was studied over a wide range of concentrations and temperatures. The hydration and solvation numbers of salts in an organic phase were determined. Extraction equilibrium constants K and the change of free energy at different temperatures were estimated by extrapolation to zero concentration. The heat of extraction at different concentrations and the extrapolated value at infinite solution were estimated by direct measurements in a specially constructed differential microcolorimeter. The changes of entropy were calculated. The relations found between thermodynamic characteristics of extraction and the structure of ions are discussed. (LK)

16780 MUTUAL EFFECTS OF ELEMENTS IN THE EXTRACTION BY LONG-CHAIN AMINE SALTS. Bagreev, V. (Inst. of Geochemistry and Analytical Chemistry, Moscow); Zolotov, Yu. A.; Tseryuta, Yu. S.; Yudushkina, L. M.; Kutyrev, I. M.; Fischer, C.; Muehl, P. pp 1883-1890 of Proceedings of the International Solvent Extraction Conference. Vol. II. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P2.

The influence of different factors on the extraction of micro-quantities of In, Tl, Fe, Cd, Co, Zn, W, Mo, Zr, Nb, Am and Eu (microelement) from halogen hydride solutions by amine salts as well as quaternary ammonium bases in the presence of macro-quantities of Fe, Ga, Co, Zn, Cd, Mo, Nb and Ta (macroelement) has been studied. Remarkable influences of macro-quantities of certain metals on the extraction of micro-quantities of other metals are found. In the majority of cases the distribution coefficients of microelements in the presence of extractable macroelements are found to decrease, i.e., suppression of the microelement extraction is observed. The dielectric constants and conductivities of organic solutions of metal species and their

dependence on concentration have been measured. Some features connected with the mutual influence of elements in the extraction systems with amines are reported. The mechanism of this phenomenon is discussed. (auth)

16781 PROCEEDINGS OF THE INTERNATIONAL SOLVENT EXTRACTION CONFERENCE, LYON, FRANCE, SEPTEMBER 8–14, 1974. Volume 3. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974). 1026p. (CONF-740917-P3).

Fifty-one papers were presented at the conference and included in Volume 3. Separate abstracts were prepared for 3 papers. Twenty-three papers appeared previously in NSA. For abstracts of these papers see 30:26525 and 32:43, 49, 50, 51, 52, 53, 56, 57, 59, 60, 61, 67, 73, 75, 76, 77, 78, 79, 201, 205, 207, and 3163. (LK)

For abstracts of individual papers see: 16782–16784.

16782 APPLICATION OF NEWLY DEVELOPED MATERIALS FOR EXTRACTION CHROMATOGRAPHY OF INORGANIC SALTS IN COLUMNS. Kroebel, R.; Meyer, A. (Bayernwerk, A. G., Munich). pp 2095-2107 of Proceedings of the International Solvent Extraction Conference. Vol. III. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P3.

The well-known analytical technique of extraction chromatography of inorganic compounds by means of liquid extractants sorbed on a material to form a fixed bed can now be extended to technical use. This is due to newly developed resins which avoid bleeding of extractant, offer grain sizes and low flow resistance similar to usual ion exchangers and have a kinetic behavior like droplets of extractant of the same size. As a non-exclusive example, the results of an extraction chromatographic pilot unit for the refining of uranyl nitrate are presented. The resin contains as extractant pure undiluted tri-n-butylphosphate (TBP). (auth)

16783 DILUENTS AND MODIFIERS: THEIR EFFECT ON MASS TRANSFER AND SEPARATION. Ritcey, G. M.; Lucas, B. H. (Extraction Metallurgy Div., Ottawa). pp 2437-2481 of Proceedings of the International Solvent Extraction Conference. Vol. III. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P3.

The diluents as well as the modifiers chosen for mixing with the extractant can have an important bearing on the solvent mixture. The physical properties of the system with regard to dispersion and coalescence, as well as the extraction and separation of metals can often be related to the selection of the diluent and modifier. Properties such as dielectric constant, polarity, aromaticity, and solubility parameters of diluents are discussed. Increase in polarity or dielectric constant are shown to adversely affect extractability. Also the concentration of aromatics, paraffins, or naphthenes in the diluent, as well as the solubility parameter, influence the extractability and separation of metals more in some systems than in other systems. The influence of the modifier in the process does not appear to follow any defined pattern, and therefore evaluation is required before a choice is made. Proper selection of the diluent and modifier and therefore equipment type stages required and the capital cost of equipment and solvent inventory. (auth)

16784 SOLVENT EXTRACTION OF HNO_3–HF FROM STAINLESS STEEL PICKLING SOLUTIONS. Kuylenstierna, U. (Stora Kopparbergs Bergslage AB, Falun, Sweden); Ottertun, H. pp 2803-2816 of Proceedings of the International Solvent Extraction Conference. Vol. III. Jeffreys, G. V. (ed.). London; Society of Chemical Industry (1974).

From international solvent extraction conference; Lyon, France (8 Sep 1974). See CONF-740917-P3.

A solvent extraction process for the recovery of acids and metals from the waste solutions produced by stainless steel pickling plants is described. The pickling acids, the monovalent acids HNO_3 and HF are extracted by tributylphosphate (TBP). The metals are recovered from the raffinate by precipitation. In addition to a theoretical evaluation of the process, pilot-plant experiments on both mixer-settlers and pulsed sieve-plate columns have been carried out. Based on the development work, a plant has been built by Stora Kopparbergs Bergslags AB at their Stainless Steel Works in Söderfors, Sweden. (auth)

16785 DETECTION OF RADIOACTIVE COMPOUNDS DURING DEVELOPMENT ON A THIN LAYER. Jimeno de Osso, F. (Junta de Energia Nuclear, Madrid). J. Chromatogr.; 96: No. 2, 239-241(Sep 1974).

16786 REVERSED-PHASE EXTRACTION CHROMATOGRAPHIC SEPARATION OF SCANDIUM FROM THE RARE EARTHS, URANIUM, AND ZIRCONIUM. Shimizy, T. (Gunma Univ., Maebashi, Japan). J. Chromatogr.; 96: No. 2, 262-265 (Sep 1974).

16787 SEPARATION OF MOLYBDENUM AND TECHNETIUM ON DI-2-ETHYLHEXYL-PHOSPHORIC ACID (D-2-EHPA)-KIESELGUHR. D'Olieslager, W.; Indesteege, J.; D'Hont, M. (Univ., Louvain, Belgium). Talanta; 22: No. 4-5, 395-399(Apr 1975).

The distribtuion ratio of Mo(VI) and Tc(VII) in different acid media on D-2-EHPA–kieselguhr was studied in batch experiments. From these data a separation procedure for Mo–Tc is proposed, which consists in the selective elution of Tc(VII) and Mo(VI) by reverse-phase partition chromatography. The D-2-EHPA–kieselguhr column can also be used as a solid phase for a ^{99m}Tc generator. (auth)

16788 EXTRACTION OF CHROMIUM(VI) FROM SULFURIC ACID SOLUTIONS BY 4-(5-NONYL)PYRIDINE AND ITS SEPARATION FROM FISSION PRODUCTS. Iqbal, M.; Ejaz, M. (Pakistan Inst. of Nuclear Science and Tech., Rqwalpindi). Anal. Chim. Acta; 74: No. 1, 125-132(Jan 1975).

4-(5-Nonyl)pyridine, a new liquid anion exchanger, has been studied for the extraction of chromium (VI) from sulfuric acid solutions. The optimal acidity is 0.1–1 M, depending on the concentration of chromium. Common anions have little effect on extraction in concentrations up to 0.1 M. Reducing agents such as ascorbic acid and thiosulfate prevent extraction at concentrations above 0.1 M. Separation of chromium(VI) from fission products was achieved. (NL)

16789 GAS CHROMATOGRAPHY OF CERIUM-GROUP LANTHANIDE CHELATES OF DIPIVALOYLMETHANE. Kito, A.; Miyake, Y. (Government Industrial Research Inst., Osaka, Ikeda (Japan)). Osaka Kogyo Gijutsu Shikenjo Kiho; 25: No. 2, 93-97 (Jul 1974). (In Japanese).

In order to separate the cerium-group lanthanide chelates of dipivaloylmethane (DPM) by gas chromatography (GC), the GC behaviors of these chelates were investigated. The lanthanide chelates of DPM and pivaloyltrifluoroacetone have been synthesized and applied to separate yttrium-group lanthanides. But they have not been separated completely by the GC technique. This paper describes the GC behaviors of cerium-group chelates of DPM. The results obtained were as follows: 1) from the experimental results about peak resolution, we found that Silicone XE-60 was the most satisfactory liquid phase for the separation, 2) the separation of neighboring elements chelates was difficult, 3) the mixtures of $Gd(DPM)_3$–$Nd(DPM)_3$, $Gd(DPM)_3$–$Pr(DPM)_3$, $Gd(DPM)_3$–$La(DPM)_3$, $Eu(DPM)_3$–$Pr(DPM)_3$, $Eu(DPM)_3$–$La(DPM)_3$, and $Sm(DPM)_3$–$La(DPM)_3$ were separated satisfactorily. The proposed GC techniques for the separation of lanthanide chelates will be able to be applied to the analyses of their mixed systems. (auth)

16790 THE SOLVENT EXTRACTION BEHAVIOR OF SOME METALS IN TBP SOLVENT SYSTEM. Yoshizawa, S. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy); Shimotori, S. Tech. Rep. Inst. At. Energy, Kyoto Univ.; No. 159, 1-5(Mar 1973).

Addition of ammonium thiocyanate solution to the system of TBP-kerosene solvent increases the distribution coefficient of thorium. The separation of thorium from some metals, such as, cerium(IV), lanthanum, yttrium, and zirconium was carried out by the above solvent extraction procedure. It was found that the separation of thorium from zirconium is almost impossible by this procedure, but other metals separate from thorium under the particular condition. (auth)

16791 REMOVAL OF DISSOLVED MOLYBDENUM FROM WASTEWATERS BY PRECIPITATES OF FERRIC IRON. LeGendre, G. R.; Runnells, D. D. (Univ. of Colorado, Boulder). Environ. Sci. Technol.; 9: No. 8, 744-749(Aug 1975).

Molybdenum is an important industrial element. It is also an essential metallic cofactor in several enzymes. At high concentrations in forage it can be toxic to ruminant animals. High concentrations of Mo are in the aqueous, solid, and airborne effluents from many industrial operations. In the laboratory it can be removed from aqueous effluent by adsorption or coprecipitation with solid ferric oxyhydroxide at low pH. A field example is given, taking place today in a stream in Colorado that receives dissolved molybdenum from a mining and milling operation. The precipitate in the stream is a mixture of iron compounds, including natrojarosite, $NaFe_3(SO_4)_2(OH)_6$, goethite, FeO(OH), and amorphous material enriched in molybdenum. (auth)

16792 CATION AND ANION EXCHANGE STUDIES OF TWENTY CATIONS IN AQUEOUS SOLUTIONS OF FORMIC, OXALIC, TAR-

TARIC AND CITRIC ACIDS AND THEIR ALKALI METAL SALTS. Qureshi, M.; Rathore, H. S.; Kaushik, R. C. (Aligarh Muslim Univ., India). Anal. Chem.; 47: No. 9, 1710-1712(Aug 1975).

The ion exchange behavior of some cations on cation exchange resins and on anion exchange resins in aqueous solutions of carboxylic acids and their salts with concentrations ranging from 2 to 10 percent was examined. The results, such as distribution coefficients, possible separations, and actual separations are reported. (LK)

16793 CHROMATOGRAPHY OF 49 METAL IONS ON STANNIC ANTIMONATE PAPERS IN DIMETHYLSULFOXIDE: NITRIC ACID SYSTEMS AND AQUEOUS NITRIC ACID SYSTEMS. Qureshi, M. (Aligarh Muslim Univ., India); Varshney, K. G.; Rajput, R. P. S. Anal. Chem.; 47: No. 9, 1520-1524(Aug 1975).

Chromatographic separations of 49 metal ions on stannic antimonate papers have been performed using mixed solvent systems containing DMSO. Aqueous HNO_3 systems have also been used. The utility of the papers has been demonstrated by achieving various difficult separations. Some of the important separations (R/sub f/ values given in parentheses) are: Cs^+(0.20)-K^+(0.30) and Sm^{3+}(0.00)-Pr^{3+}(0.72) in pure DMSO; Nb^{5+}(0.14)-VO^{2+}(0.95) in DMSO-6M HNO_3 (1:1); Ti^{4+}(0.00)-VO^{2+}(0.97) in DMSO-0.5M HNO_3 (1:1); and Ba^{2+}(0.06)-K^+(0.52)-Sr^{2+}(0.95), Ba^{2+}(0.04)-Cs^+(0.41)-Mg^{2+}(0.93), and Ca^{2+}(0.10)-Sr^{2+}(0.94) in DMSO-0.1M HNO_3 (1:1). The time of development in each case is two hours. A discussion is presented on the dependence of Ri, log R/sub f/, and R/sub M/ on pH of the solvent to understand the mechanism of the movement of metal ions on papers impregnated with inorganic materials. (auth)

16794 ANION-EXCHANGE ISOLATION OF RARE-EARTH ELEMENTS FROM APATITE MINERALS IN METHANOL-NITRIC ACID MEDIUM. Roelandts, I. (Univ., Liege); Duyckaerts, G.; Brunfelt, A. O. Anal. Chim. Acta; 73: No. 1, 141-148(Nov 1974).

Batch distribution coefficients, K_d, of rare-earth elements (REE) and other elements were determined radiochemically for a strongly basic nitrate anion-exchange resin Dowex 1-X8 100-200 mesh, in nitric acid-methanol media of varying composition. This method was developed for the separate recovery of REE from apatite minerals. Calcium and other common elements of the apatite are eluted by a 5% (v/v) 7 M nitric acid-95% methanol mixture, while the REE are retained. The REE are recovered and separated into two fractions; the heavier REE by elution with a 45% nitric acid-55% methanol mixture, and a very clean fraction of La, Ce, Pr, Nd by elution with water. (auth)

16795 EXTRACTION OF METAL CHELATES WITH 3,5-HEPTANEDIONE AND 5-METHYL-2,4-HEXANEDIONE. Vlacil, F.; Sayeh, B. M. (Inst. of Chemical Technology, Prague). Collect. Czech. Chem. Commun.; 40: No. 5, 1358-1366(May 1975).

The extraction of the chelates of Cu(II), Co(II), Ni(II), Fe(III), Be(II), Al(III), Ga(III), In(III), U(VI), Th(IV), Zr(IV) and Hf(IV) with solutions of 3,5-heptanedione and 5-methyl-2,4-hexanedione in benzene was studied. The extraction curves and the calculated values of the extraction constants and pH_4 are given. Co, Ni, Zr and Hf are incompletely extracted; the conditions for complete extraction of the other chelates were found. (auth)

16796 GENERAL CHARACTERIZATION OF THE SORPTION PROPERTIES OF FERROCYANIDES OF BIVALENT TRANSITION METALS. Vol'khin, V. V.; Zil'berman, M. V.; Kolesova, S. A.; Shul'ga, E. A. J. Appl. Chem. USSR.; 48: No. 1, 52-56(Jan 1975).

Translated from Zh. Prikl. Khim.; 48: No. 1, 54-59(Jan 1975).

A model of the structure of ferrocyanides of bivalent transition metals, with vacancies in the positions of $Fe(CN)_6^{4-}$ ions taken into account, was used in an examination of the special features of sorption processes occurring on ferrocyanides, such as ion exchange of alkali metals, molecular sorption of alkali metal and ammonium salts, electron exchange, and heterogeneous ion-exchange reactions (exchange of transition-metal ions). (auth)

Inorganic, Organic, and Physical Chemistry

16797 TEMPERATURE DEPENDENCE OF THE DIFFUSION COEFFICIENT OF $^{14}CO_2$ IN DILUTE HCl. Hawke, J. G. (Macquarie Univ., Sydney); White, I. J. Phys. Chem.; 79: No. 15, 1614-1617(17 Jul 1975).

The temperature dependence of the diffusion coefficients for ^{14}C labeled carbon dioxide gas diffusing in dilute HCl solutions has been measured. The radioactively labeled gas was trapped as it diffused out of unstirred aqueous solutions. The diffusion curves were analyzed according to the mathematical model proposed by Hawke and Parts. The data obtained are from 10 to 20 percent higher than the literature values measured by a variety of techniques. The wide variations in these quoted values may well be due to uncontrolled variations in the pH of the solutions used. It is proposed that our results refer to the diffusion of free CO_2 in water whereas almost all other workers have measured the diffusion coefficients in solutions, having a pH greater than 4.0 which are a weighted mean of D/sub CO_2/, D/sub HCO_3^-/, and D/sub CO_3^{2-}/. Values of E/sub D/ and DELTA S* calculated from Eyring's transition-state theory support the decreased interaction between CO_2 and water in acid solutions. (auth)

Chemical and Physicochemical Properties

Refer also to abstracts 16953, 17753, and 18294.

16798 (CEA-Bib-216) SOLUBILITY OF NICKEL IN WATER. Bibliographical Study of the Standard Thermodynamic Quantities of Nickel at the Degree of Oxidation II. Lambert, I. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Chimie). May 1975. 13p. (In French). Dep. NTIS (US Sales Only) $4.00.

A bibliographical study of the equilibria between nickel oxides and ferrites, and ions at oxidation II in aqueous solution was carried out in support of research on the water chemistry of reactors. The different values of the free enthalpies of formation of these species at 298°K, calculated from published values, are discussed. (30 references) (auth)

16799 HEAT AND MASS EXCHANGE ON HORIZONTAL TUBES DURING CONDENSATION OF VAPORS OF THE N_2O_4 SYSTEM IN A NON-EQUILIBRIUM STATE. Borishanskii, V. M.; Derov, V. T.; Kolykhan, L. I.; Nesterenko, V. B.; Peslyak, V. I.; Pulyaev, V. F. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 77-84(1975). (In Russian).

Results of the heat and mass transfer experimental investigation at the condensation of the chemically reacting nonequilibrium system $2NO + O_2 \rightleftharpoons 2NO_2 \rightleftharpoons N_2O_4$ on the outside surface of a horizontal tube are considered taking into account kinetics of the chemical reaction. The presence of the recombining components NO and O_2 doesn't lead to a considerable decrease in heat and mass transfer at the filmwise condensation. The generalized criterional relationship is given. (auth)

16800 EXPERIMENTAL STUDY OF THE PvT DEPENDENCE OF DISSOCIATING NITROGEN TETROXIDE AT P = 5 TO 190 BAR AND T = 340 TO 580°K. Klepatskii, P. M.; Shankin, V. F. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 68-76(1975). (In Russian).

The experimental study of PvT of N_2O_4 within the scope of thermodynamic parameters of practical interest was carried out on the constant volume piezometer. 172 values of specific volume of nitrogen tetroxide were obtained. Maximum relative error is estimated as 0.25%. Analytical treatment of experimental values resulted in the new interpolation state equation, fitting the experimental PvT surface with the standard error of 0.16%. (auth)

16801 STUDY BY ABSORPTION SPECTROPHOTOMETRY OF THE CHEMICAL PROPERTIES OF PLUTONIUM IN THE MOLTEN EUTECTIC SYSTEM LiCl–KCl. Landresse, G.; Duyckaerts, G. (Univ., Liege). Anal. Chim. Acta; 73: No. 1, 121-127(Nov 1974). (In French).

Visible and near-infrared absorption spectrophotometry provides a satisfactory method for the study of the chemical reactions of plutonium in fused LiCl–KCl eutectic with Cl_2, HCl, or O_2. Comparison of the spectra obtained with those of known species leads to the identification of $PuCl_6^{2-}$ and $PuO_2Cl_4^{2-}$ in the melt. A new potential/pO^{2-} diagram is presented; this allows interpretation of the various observed chemical reactions. (auth)

16802 A CONTRIBUTION TO THE KINETIC STUDY ON THE REACTION OF TRANSITION METALS WITH GASES. Hotta, K.; Hashino, T.; Nishi, T. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy). Tech. Rep. Inst. At. Energy, Kyoto Univ.; No. 160, 1-15 (Jul 1973).

This attempt is concerned with relating the unique chemical reactivity of transition metals with gaseous atmosphere at elevated temperatures to the phase transformation of the parent crystal lattice. Because of sufficient similarity in the behavior of transition metals in the chemical reactions, the use of titanium metal which does not substantially suffer severe contamination under ordinary conditions is sufficient to obtain the information about the reaction in typical terms. In this approach attention was confined to a reversible system, i.e., titanium-hydrogen system. On the basis of DTA-curves observed, the change occurring with respect

to the parent metal phase was discussed, and the kinetic parameters were determined. It has been established that the reversible reaction with hydrogen accompanies change in the activation entropy, and that the hysteresis of the reaction seems to be due to a relaxation of the parent lattice deformation. (auth)

Isotope Effects

Refer also to abstracts 16831 and 18362.

16803 VAPOR PRESSURES OF AQUEOUS MELTS: $LiNO_3$ + KNO_3 MELTS CONTAINING WATER OR DEUTERIUM OXIDE. Tripp, T. B. (Univ. of Maine, Orono). J. Chem. Thermodyn.; 7: No. 3, 263-269(Mar 1975).

Vapor pressures of $LiNO_3$ + KNO_3 + H_2O and $LiNO_3$ + KNO_3 + D_2O were measured over the temperature range 383 to 423 K by a differential transpiration method. The mole ratio $n(H_2O$ or $D_2O)/n(NO)_3^-$ was varied from approximately 0.15 to 0.7. The mole ratio $n(Li^+)/n(K^+)$ was 1.00. The vapor pressures of both water and deuterium oxide melts obey Henry's law over the composition range studied. The temperature dependence of the Henry's law constants yields an enthalpy of vaporization of (10.6 ± 0.1) $kcal_{th}$ mol^{-1} for melts containing D_2O and (10.5 ± 0.1) $kcal_{th}$ mol^{-1} for melts containing H_2O. (auth)

16804 VIBRATION SPECTRA OF H_2SO_4 AND D_2SO_4 ACIDS IN THE CRYSTALLINE STATE. Goypiron, A.; De Villepin, J.; Novak, A. (Centre National de la Recherche Scientifique, Thiais, France). Spectrochim. Acta, 31A: No. 7, 805-818(Jul 1975). (In French).

The infrared and Raman spectra (4000-50 cm^{-1}) of crystalline H_2SO_4 and D_2SO_4 were investigated at various temperatures. Infrared dichroism of oriented films of these compounds at 90°K was studied in the 4000-200 cm^{-1} region. An assignment for all 15 intramolecular fundamentals is given. Correlation field splitting is observed for most vibrations. All the six liberations R', corresponding to hydrogen bond vibrations, were identified. The spectroscopic and x-ray data concerning the crystalline structure and the hydrogen bonding are compared. The OH stretching bandwidth is discussed. (auth)

16805 INFRARED AND FAR INFRARED SPECTRA OF NORMAL, C-, N-, AND PER-DEUTERATED 1,2-ETHANEDIAMINE. Borring, A. L.; Rasmussen, K. (Denmark Tekniske Hoejskole, Lyngby). Spectrochim. Acta, Part A; 31A: No. 7, 889-893(Jul 1975).

Spectra of the complete series of symmetrically deuterated ethylenediamines in solution are reported, leading to slight revisions of earlier assignments. The group frequency approximation is examined. (auth)

16806 TRIBOLUMINESCENCE AND ASSOCIATED DECOMPOSITION OF SOLID METHANOL. Trout, G. J. (Univ. of Sydney); Moore, D. E.; Hawke, J. G. J. Phys. Chem.; 79: No. 15, 1519-1527(17 Jul 1975).

An investigation of the phase change induced decomposition of methanol was carried out. The decomposition is initiated by the cooling of solid methanol through the $\beta \rightarrow \alpha$ transition at 157.8 K, producing the gases hydrogen, carbon monoxide, and methane. The passage through this λ transition causes the breakup of large crystals of β-methanol into crystallites of α-methanol and is accompanied by light emission as well as decomposition. The emitted light exhibits the properties of gas discharge triboluminescence, being accompanied by, and apparently produced by, electrical discharges through methanol vapor in the vicinity of the solid. The light has a spectrum similar to that produced by an electrical discharge through methanol vapor at low pressure. The potential differences needed to produce the electrical breakdown of the methanol vapor apparently arise from the disruption of the long hydrogen bonded chains of methanol molecules present in crystalline methanol. Charge separation following crystal deformation is a characteristic of substances which exhibit gas discharge triboluminescence; solid methanol has been found to emit such luminescence when mechanically deformed in the absence of the $\beta \rightarrow \alpha$ transition. Characteristics of the discharges are affected by the nature and pressure of the gas above the methanol. The decomposition products are not produced directly by the breaking up of the solid methanol but from the vapor phase methanol by the electrical discharges. That gas phase decomposition does occur was confirmed by observing that the vapors of C_2H_5OH, CH_3OD, and CD_3OD decompose on being admitted to a vessel containing methanol undergoing the $\beta \rightarrow \alpha$ phase transition. The composition of the gas evolved from methanol and deuterated methanols was explained using reactions occurring on electron impact in mass spectrometry. (auth)

16807 THERMOCHEMICAL ISOTOPE EFFECTS. III. Hydrogen–Deuterium Exchange Between Methanol and Water at 25°. Bertrand, G. L.; Burchfield, T. E. (Univ. of Missouri, Rolla). J. Phys. Chem.; 79: No. 15, 1547-1550(17 Jul 1975).

Enthalpies of solution of small amounts of D_2O and CH_3OD in mixtures of methanol and water at 25° have been interpreted in terms of the equilibrium (CH_3OH + HDO equals CH_3OD + H_2O). The enthalpy of this reaction appears to vary from −100 cal/mol in methanol to −200 cal/mol in water. Approximations are introduced to account for this variation. "Best" estimates of the equilibrium constant are 0.6 in methanol and 0.6–0.7 in water. (auth)

16808 EXACT QUANTUM, QUASICLASSICAL, AND SEMICLASSICAL REACTION PROBABILITIES FOR THE COLLINEAR $F + D_2 \rightarrow FD + D$ REACTION. Schatz, G.C.; Bowman, J.M.; Kuppermann, A. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). J. Chem. Phys. 63: No. 2, 685-696 (15 July 1975).

Exact quantum, quasiclassical, and semiclassical reaction probabilities and rate constants for the collinear reaction $F + D_2 \rightarrow FD + D$ are presented. In all calculations, a high degree of population inversion is predicted with P^R_{03} and P^R_{04} being the dominant reaction probabilities. In analogy with the $F + H_2$ reaction (preceding paper), the exact quantum 0→3 and 0→4 probabilities show markedly different energy dependence with P^R_{03} having a much smaller effective threshold energy (E_T=0.014 eV) than P^R_{04} (0.055 eV). The corresponding quasiclassical forward probabilities P^R_{03} and P^R_{04} are in poor agreement with the exact quantum ones, while their quasiclassical reverse and semiclassical counterparts provide much better approximations to the exact results. Similar comparisons are also made in the analysis of the corresponding EQ, QCF, QCR, and USC rate constants. An information theoretic analysis of the EQ and QCF reaction probabilities indicates nonlinear surprisal behavior as well as a significant isotope dependence. Additional quantum results at higher energies are presented and discussed in terms of threshold behavior and resonances. Exact quantum reaction probabilities for the related $F + HD \rightarrow FH + D$ and $F + DH \rightarrow FD + H$ reactions are given and an attempt to explain the observed isotope effects is made. (auth)

16809 DYNAMICS OF THE REACTION OF F^+ WITH D_2. Wendell, K.; Jones, C.A.; Kaufman, J.J.; Koski, W.S. (Department of Chemistry, The Johns Hopkins University, Baltimore, Maryland 21218). J. Chem. Phys. 63: No. 2, 750-756 (15 July 1975).

The energy and angular distribution of the ionic products from the reaction $F^+(D_2,D)FD^+$ were measured as a function of primary ion energy ranging from 0.7 to 12.5 eV in the laboratory system. At the low energies the distribution showed a high degree of symmetry although some forward peaking was detectable. At the higher energies the distribution was asymmetric relative to ±90° indicating that the reaction was proceeding by an impulsive direct mechanism. A study of the exoergicity as a function of projectile energy shows that the bulk of the exothermicity of the reaction is converted into vibrational energy in the product ion. Failure to observe the reaction $F^+(D_2,FD)D^+$ was attributed to a violation of the spin and symmetry conservation rules. (auth)

16810 PSEUDOROTATIONAL LOCAL MODE PARTICIPATION IN OH AND OD($A\,^2\Sigma^+$) VIBRATIONAL RELAXATION IN A Ne LATTICE. Brus, L.E.; Bondybey, V.E. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Chem. Phys. 63: No. 2, 786-793 (15 July 1975).

Radiationless transitions within the $A\,^2\Sigma^+$ state of OH and OD in a Ne lattice at 4.2°K are observed. The radicals are substitutional impurities undergoing slightly perturbed free rotation [D. S. Tinti, J. Chem. Phys. 48, 1459 (1968)]. The local phonon relaxation time is ⩽ 10 nsec. Emission spectra show an intermediate strong coupling (or resonant mixing) occurring between rotational levels and lattice phonon levels. The $v'=0$ lifetimes are 582±10 and 565±10 nsec on OH and OD, respectively, with fluorescence quantum yields >0.90. The Lorentz–Lorenz dielectric model overestimates the vacuum to solid radiative rate increase by a factor of two. At high radical concentrations Förster transfer from OD($v'=0$) to OH($v'=0$) occurs. The vibrational relaxation rates are fast (4×10^4–4×10^5 sec^{-1}), with higher rates in OH despite the larger vibrational energy gaps in OH. The rates are extremely sensitive to lattice defects and/or additional impurities causing small (⩽0.3 Å) red or blue shifts from the principal site spectra. The principal accepting modes appear to be pseudorotational localized modes. Defects appear to enhance relaxation by creating additional localized modes. (auth)

16811 INTERDEPENDENCE OF GUEST RADIATIONLESS TRANSITIONS AND LOCALIZED PHONON STRUCTURE: NH AND ND($A\,^3\Pi$) IN RARE GAS LATTICES. Bondybey, V.E.; Brus, L.E. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Chem. Phys. 63: No. 2, 794-804 (15 July 1975).

Time and wavelength resolved fluorescence techniques are used to study vibrational relation of NH and ND($A\,^3\Pi$) substitutional guests in rare gas lattices. Temperature dependent localized phonon spectral structure is analyzed to show that the ground $X\,^3\Sigma^-$ state undergoes

near free rotation, while the excited $A\,^3\Pi$ state librates. The barriers to free rotation in $A\,^3\Pi$ reflect the anisotropy of the attractive, polarizability dependent NH–lattice interaction. The vibrational relaxation energy gap law is strongly violated, with NH rates 10–10^2 higher than ND rates. These rates are independent of temperature for $T \leq 25\,^\circ$K in Ar, and $T \leq 37\,^\circ$K in Kr; however, intersystem crossing by $A\,^3\Pi$ ($v=0$) in Kr shows a dramatic temperature dependence resulting from stimulated phonon emission. It is proposed that the localized near free rotation mode accepts energy during vibrational relaxation, while delocalized lattice phonon modes accept energy during intersystem crossing. The average accepting frequency in Kr is only $\simeq (1/2)$ the host phonon maximum frequency, thus indicating that single accepting frequency theories are only semiquantitatively applicable. (auth)

16812 SINGLE ROTATIONAL LEVEL EXCITATION OF CO($e\,^3\Sigma^-$) BY ATOMIC SULFUR RADIATION. Slanger, T.G.; Black, G. (Molecular Physics Center, Stanford Research Institute, Menlo Park, California 94025). J. Chem. Phys. 63: No. 2, 969-974 (15 July 1975).

Direct population of the $v=4$, $J=K=27$ level of the $e\,^3\Sigma^-$ state of ^{12}CO has been accomplished by absorption of the 1483.039 Å Si line. Perturbations of this level by the nearby $A\,^1\Pi$ state make this particular $e\,^3\Sigma^- \leftarrow X\,^1\Sigma^+$ transition strong. Resonance of the Si line with the $e\,^3\Sigma^- - X\,^1\Sigma^+$ transition is destroyed by substitution of ^{13}CO for ^{12}CO, but ^{13}CO has a very strong resonance, with a different Si line, in the $A\,^1\Pi \leftarrow X\,^1\Sigma^+$ system. The behavior of the observed emission intensities as a function of varying the CO and inert gas pressures indicates that collisionally induced cross-relaxation processes between the $A\,^1\Pi$ and $e\,^3\Sigma^-$ states are extremely rapid, their frequencies being greater than gas kinetic collision frequency in the case of CO. (auth)

16813 ISOTOPE EFFECTS IN SOLUTIONS OF HYDROGEN AND DEUTERIUM IN NIOBIUM. Steward, S.A. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). J. Chem. Phys. 63: No. 2, 975-979 (15 July 1975).

Hydrogen and deuterium equilibrium pressures in the region of single-phase solid solutions (α phase) with niobium were collected. These measurements were within the temperature and composition ranges of 535 to 773 K and 0.02 to 0.20 hydrogen atomic fraction. Good partial molar enthalpy and entropy values were calculated from these data. A ground-state hydrogen vibration frequency of 1800 ± 50 K (3.8×10^{13} Hz) was derived by assuming a harmonic oscillator model. Finally, the results are compared with those obtained for the Group VB metals by other authors. (auth)

16814 AUTOIONIZATION IN DIATOMICS: MEASURED LINE SHAPE PARAMETERS AND PREDICTED PHOTOELECTRON SPECTRA FOR SOME AUTOIONIZING STATES OF THE HYDROGEN HALIDES. Terwilliger, D.T.; Smith, A.L. (Department of Chemistry, Yale University, New Haven, Connecticut 06520). J. Chem. Phys. 63: No. 2, 1008-1020 (15 July 1975).

Using a Hopfield continuum source and a computer-controlled data acquisition system, we have measured relative absorption cross sections for HCl, DCl, HBr, DBr, and HI at 0.2 Å resolution from 1000 to 700 Å, a region dominated by autoionizing Rydberg states converging to the $A\,^2\Sigma^+$ state of the HX^+ ion. In order to analyze the shapes of autoionizing vibrational bands, we applied Fano's theory of line shapes to homogeneous autoionization in diatomics, and found that the line shape parameters q, Γ, and ρ^2 are independent of rotational quantum number but may depend upon the vibrational quantum number of the autoionizing state. Calculations of this vibrational dependence in HCl shows it to be most pronounced at high v. For progression I in HCl and DCl ($n^* = 2.79_5$) and in HBr and DBr ($n^* = 2.74_8$), we fit computer-generated vibronic band contours to experimental absorption cross sections to obtain q, Γ, and ρ^2 which we then used to predict the photoelectron spectra of these autoionizing states. The autoionization lifetime $\hbar/\Gamma$ in HCl and DCl is 1.1×10^{-14} sec; in HBr and DBr it is 9.5×10^{-15} sec. The measured autoionization widths of bands in the next member of the Rydberg series obey the scaling rule $\Gamma \propto n^{*-3}$. We attribute an additional broadening of levels with $v \geq 3$ in progression I of HBr as the onset of predissociation, and estimate the relative rates of predissociation and autoionization. A vibrational reassignment of progression II in HCl and DCl gives $n^* = 2.31_0$ for these states. We saw only a single broad peak (with $n^* = 2.78$) in the absorption spectrum of HI. (auth)

16815 ENERGY DEPENDENCE AND ISOTOPE EFFECT FOR THE TOTAL REACTION RATE OF Cl+HI AND Cl+HBr. Bergmann, K.; Moore, C.B. (Department of Chemistry, University of California, Berkeley, California 94720). J. Chem. Phys. 63: No. 2, 643-649 (15 July 1975).

A laser initiated chemical reaction method has been used to determine the total reaction rates for Cl+HI and Cl+HBr and the dependence of the rates on collision energy and H–D isotopic substitution. The rate constants are $k = 1.64 \times 10^{-10}$ cm^3 molecule^{-1}sec^{-1} ($\sigma = 33.5$ Å^2) for Cl+HI and $k = 7.4 \times 10^{-12}$ cm^3 molecule^{-1}sec^{-1} ($\sigma = 1.44$ Å^2) for Cl+HBr. Measurements were all done at 295 °K in slowly flowing gases. Substituting H by D decreases the rate constant by a factor of 1.84 in the case of HI and by 1.5 in the case of HBr. The isotope effect may be a result of tunneling on corner cutting trajectories. The cross section decreases with increasing collision energy. This, together with the large reaction cross section, indicates the importance of attractive forces in these systems. (auth)

16816 ABSOLUTE VISCOSITY OF $D_2{}^{18}O$ BETWEEN 15 AND 35^0. Wolf, D.; Kudish, A. I. (Weizmann Inst. of Science, Rehovot, Israel). J. Phys. Chem.; 79: No. 14, 1481-1482(3 Jul 1975).

The means used to obtain previously reported absolute viscosity values for pure $D_2{}^{18}O$ is reported. Values for the pure $D_2{}^{18}O$ are extrapolated from viscosity values determined for an experimental sample by applying Eyring's theory of viscosity. Due to the isotopic nature of the sample, the following assumptions are made: a quaternary solution composed of $H_2{}^{16}O$, $H_2{}^{18}O$, $D_2{}^{16}O$, and $D_2{}^{18}O$ (i.e., the presence of the HDO species is neglected), and the mole fraction of each species is the product of the mole fraction of its components. The agreement between the extrapolated values for two of three samples justifies the assumptions involved in the extrapolation procedure. (LK)

Isotope Exchange and Isotope Separation

Refer also to abstract 16894.

16817 (BNL-20232) SYNTHESIS OF PARTIALLY-DEUTERATED CHOLESTEROL. Larsen, D. L. (Brookhaven National Lab., Upton, N.Y. (USA)). [nd]. 20p. (CONF-750629-2). Dep. NTIS $4.00.

From symposium on neutron scattering for the analysis of biological structures; Upton, New York, USA (2 Jun 1975).

The synthesis of cholesterol with specific substitution of deuterium for hydrogen in positions 20 and 22 to 27 inclusive is reported. (LK)

16818 CONCENTRATION OF URANIUM-235 IN MIXTURES WITH URANIUM-238 USING ION EXCHANGE RESINS. Seko, M.; Kakihana, H. Canadian Patent 965,581. 8 Apr 1975. 49p.

A method is reported for simultaneously obtaining separate enriched fractions of ^{235}U and ^{238}U from isotopic mixtures, with the use of an ion exchange column by passing a liquid body containing the isotopic mixture through the column. The uranium as it is passed through the column is present as a U(IV) coordination compound with a ligand at different valence states. It is followed by an eluant and forms a band which travels through the column, the front and rear portions of which are respectively enriched in one of the isotopes and depleted in the other. (CA)

16819 OXYGEN EXCHANGE BETWEEN $C^{18}O_2$ AND "ACIDIC" OXIDE AND ZEOLITE CATALYSTS. Peri, J. B. (Amoco Oil Company, Naperville, IL). J. Phys. Chem.; 79: No. 15, 1582-1588 (17 Jul 1975).

The exchange of oxygen between $C^{18}O_2$ and several high-area oxides, including silica, gamma-alumina, silica–alumina, and zeolite catalysts, was studied. Infrared spectra of adsorbed CO_2 and of surface "carbonates" were used to follow the rate of oxygen exchange and investigate the nature of unusually exchangeable surface oxide ions, present at low concentrations. Interaction of CO_2 with the surface typically produced initial exchange of one oxygen atom, as expected from interaction with a single oxide ion ($CO_2 + O^{2-}$ reversible CO_3^{2-}), and the number of exchangeable ions increased with increasing temperature. The rate of oxygen exchange did not correlate with chemisorption to form stable surface carbonates or with the extent of strong physical adsorption of CO_2. With dry silica, exchange was insignificant below 600^0; with catalytically active zeolites and dry gamma-alumina, it was detectable at 200^0 and fairly rapid at 300–400^0. Silica–alumina required 100–150^0 higher temperature for exchange than did an active zeolite. Activity for cracking and other hydrocarbon reactions may be related to the ease of exchange of some surface oxide ions with CO_2. Active zeolites have reactive oxide sites resembling those on dry gamma-alumina, but such sites on zeolites are probably less-readily eliminated by chemisorption of H_2O or other compounds. (auth)

16820 SELF-EXCHANGE OF CARBON MONOXIDE BEHIND REFLECTED SHOCK WAVES. Bopp, A. F.; Kern, R. D. Jr.; O'Grady, B. V. (Univ. of New Orleans). J. Phys. Chem.; 79: No. 15, 1483-1487(17 Jul 1975).

The exchange reaction, $^{13}C^{18}O + {}^{12}C^{16}O$ reversible $^{13}C^{16}O + {}^{12}C^{18}O$ (k_1,k/sub -1/), was investigated in order to assess the importance of reactant vibrational excitation and its effect upon the isotopic switching rate. A shock tube equipped to record infrared emission was used to select two reaction environments;

one in which the vibrational equilibration of CO was established in a very short time after shock arrival (8 percent CO, 11 percent H_2, 80 percent Ne, 1 percent Ar) and one in which equilibration was about six times slower (8 percent CO, 20 percent Kr, 72 percent Ar). The rate of exchange was studied with a shock tube connected to a time-of-flight mass spectrometer over the temperature range 2900–4650°K. The time dependence for product formation was observed to be linear and there was no discernible difference in the exchange rate constants from either mixture. The rate constants from this work were combined with the tabular data of Lifshitz reported in a previous single pulse shock tube study which employed an argon diluent over the temperature range of 2000–2650°K. The results are represented by one Arrhenius line from 2000 to 4650°K; namely k/sub b/ equals $10^{12.58^{+-0.07}}$ exp (-55,470 +- 980/RT) $cm^3\ mol^{-1}\ sec^{-1}$. (LK)

16821 SEPARATION OF BORON ISOTOPES BY DIRECT MODE THERMAL PARAMETRIC PUMPING. Schroeder, H. G.; Hamrin, C. E. Jr. (Univ. of Kentucky, Lexington). AIChE (Am. Inst. Chem. Eng.) J.; 21: No. 4, 807-810(Jul 1975).

Results of boron isotope separation by direct mode thermal parametric pumping are presented. Separation is based on the exchange reaction between gaseous BF_3 and solid BF_3.DMSO. (LK)

Feed Materials Processing

Refer also to abstracts 16890 and 16954.

16822 (AWRE/LIB/BIB-28) LEACHING OF URANIUM ORES: PAPERS PUBLISHED FROM 1968. Garrett, K. H. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Jun 1975. 9p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

This bibliography contains 70 references to the acid and bacterial leaching of uranium ores and uranium recovery from solutions and slurries published from 1968. Extensive references prior to 1969 are given in "The Extractive Metallurgy of Uranium" by R. C. Merritt, published by Colorado School of Mines Research Institute (1971) and "Principles of Extractive Metallurgy" volume 2 by F. Habashi, published by Gordon and Breach (1970). (auth)

16823 (IEA-339) STUDY OF CONTINUOUS PRECIPITATION OF AMMONIUM DIURANATE FOR INSTALLATION IN THE CEQ-IEA PILOT PLANT. Adroaldo de Araujo, J. (Instituto de Energia Atomica, Sao Paulo (Brazil)). May 1974. 33p. (In Portuguese). Dep. NTIS (US Sales Only) $4.75.

Ammonium diuranate continuous precipitation with a high chemical purity degree from uranyl nitrate solutions was accomplished using 1.2 and 2.4 M ammonium hydroxide solutions and gaseous NH_3 as a precipitating agent. The precipitations were carried out in a continuous procedure with one and two stages. The variables studied were the NH_4OH solutions concentration, ADU precipitation curve, the flow rate of reactants, the temperature of the precipitation pH of the suspended ADU and ammonium diuranate filtrability. The experimental work performed here and the data obtained permitted the design of a chemical reactor for the continuous nuclear grade ADU precipitation. (auth)

16824 (IEA-343) DIMENSIONING INDUSTRIAL PULSED COLUMNS IN URANIUM PURIFICATION BY THE INDIRECT HTU METHOD. Franca, J. M. Jr.; Messano, J. (Instituto de Energia Atomica, Sao Paulo (Brazil)). May 1974. 50p. (In Portuguese). Dep. NTIS (US Sales Only) $5.50.

A detailed study was made on the parameters that are necessary in the measurement of three industrial pulsed columns set, together its pulse generator, of mechanic conventional type, for a average/year production of 500 tons in high uranium purity for nuclear designs. The calculations are given, considering the objectives of each column: extraction, scrubbing, and stripping. The diameters of the columns as a function of both organic and aqueous-phases were calculated. The calculation on the unity transfer number for each column type is detailed, through the graphic integration method. The columns' HTU (height equivalent plates) was determined. Plottings with operation and equilibrium curves were prepared and used for the HTU's calculation. Lists that helped the mathematical development of this process were made. Pulse conditions adopted, necessary power, and limit frequency of operation as a function of conditions existent in the system were considered. (auth)

16825 IN-SITU LEACHING OPENS NEW URANIUM RESERVES IN TEXAS. White, L. (ed.). Eng. Min. J.; 176: No. 7, 73-81(Jul 1975).

A commercial in-situ uranium leaching operation that is quite probably the largest ever built started up in April, 10 mi southwest of George West, Tex. Producing from a pattern of 66 injection wells and 46 extraction wells occupying an area of less than 3 acres, the Clay West mine and plant are expected to reach design capacity of 250,000 lb per year of yellowcake by the end of the summer. By late May, results were sufficiently favorable to make the owners think seriously about an early expansion. Built at a cost of $7 million by joint ventures Atlantic Richfield (50 percent owner and operator), Dalco (25 percent), and US Steel (25 percent), the Clay West mine may be only the first of several mines to extract U_3O_8 from a uranium province that stretches from north of Houston to Brownsville, at the southernmost tip of the state. Westinghouse subsidiary Wyoming Minerals is building a 250,000-lb-per-year plant near Bruni, with startup planned before the end of 1975, and Mobil Oil is setting up a pilot-scale plant in the same area. A number of other companies are reported to be actively interested in development of in-situ uranium leaching in Texas. (auth)

16826 NEW DRYING-CALCINING UNIT CUTS YELLOWCAKE PROCESSING COSTS. Eng. Min. J.; 176: No. 7, 104(Jul 1975).

Processing of ammonium diuranate (yellowcake) to produce uranium oxide is a new application for the stainless steel "Turbo-Heat-Treater" unit made by Wyssmont Co. Inc. The Turbo-unit may be used to continuously dry and calcine approximately 10 tpd of yellowcake at a reduced processing cost, stemming from the very close temperature profile and the elimination of refractory requirements, the manufacturer reports. (auth)

16827 HOW TO EXTRACT URANIUM FROM REFRACTORY ORES. Caldas, A. (Federal Univ., Rio de Janeiro). Eng. Min. J.; 176: No. 7, 82(Jul 1975).

A solid-phase technique of oxidizing-sintering has been developed for recovery of uranium from essentially insoluble ores, at lower temperatures than conventional methods, with minimum use of an oxidant. (auth)

Radiation Chemistry

Refer also to abstracts 17381, 17385, 17392, 17400, and 18898.

16828 (CEA-N-1746) DEPARTMENT OF BASIC RESEARCH OF GRENOBLE. Semiannual Bulletin No. 5, 1st Semester of 1974. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1974. 152p. (In French). Dep. NTIS (US Sales Only) $10.75.

Research is reported in the areas of fission and fission products, faults and radiation defects in solids, magnetism, structure and properties of compounds, alloys and complexes of the transition elements, free stable radicals, stereochemistry and conformation studies, vegetable macromolecules, calculation of the conformation and hyperfine structure of the nitroxide group, electrochemistry of aromatics, protons dynamics in hydrogen bonding, structure and function of proteins, structure and function of biological membranes, radiobiology, vegetable physiology, and technical advances in holographic images and results obtainable with the 1 MeV microscope. Much of the research reported has already appeared or is scheduled to appear in the published literature. (JSR)

16829 (JAERI-5030) FUNDAMENTAL STUDIES IN OSAKA LABORATORY FOR RADIATION CHEMISTRY. Annual Report, April 1, 1973–March 31, 1974. (Japan Atomic Energy Research Inst., Neyagawa, Osaka. Osaka Lab. for Radiation Chemistry). Mar 1975. 164p. (In Japanese and English). Dep. NTIS (US Sales Only) $11.25.

Each of the 19 sections was abstracted and indexed separately. (LK)

For abstracts of individual sections see: 16830–16845 and 18729–18731.

16830 (JAERI-5030, pp 16-21) OPTICAL EMISSION FROM CO–H_2 MIXTURE EXCITED BY HIGH ENERGY ELECTRONS. I. Behaviors of $C_2(A \rightarrow X)$ in CO and CO–H_2 Mixture Under Electron Irradiation. Nakai, Y.; Matsuda, K.; Takagaki, T.; Harami, T. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Optical emission spectra induced by 1.5-MeV electron irradiation on CO and CO–H_2 mixtures were investigated in the wavelength region from 2000 to 6500Å. The principal spectral features for CO were the transitions $B^1\Sigma^+ \rightarrow A^1\Pi$ and $b^3\Sigma^+ \rightarrow a^3\Pi$ of CO, the $B^2\Sigma^+ \rightarrow A^2\Pi_i$ of CO^+, and the $A^3\Pi_g \rightarrow X^3\Pi_u$ of C_2. The intensities of emissions from excited states of CO and from CO^+ were not proportional to the pressure of CO, and decreased with irradiation time due to collisional energy transfer to a product from irradiated CO. The strong emission of $A \rightarrow X$ from C_2 was observed, and its behaviors with original sample pressure, dose

rate, and total dose were quite different from others. For the system of CO–H_2, the emission of A → X(0,0) of C_2 was enhanced remarkably at some optimum conditions for the amount of H_2 added to CO, dose rate and total dose. (auth)

16831 (JAERI-5030, pp 22-25) DISSOCIATIVE RESONANCE ELECTRON CAPTURE IN METHYLMERCAPTANE AND METHYLMERCAPTANE-d_3. Sugiura, T.; Arakawa, K. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

The formation of negative ions by electron impact of methylmercaptane and methylmercaptane-d_3 was investigated as a function of the electron energy. Appearance potentials, energies of resonance peaks, full widths of half maxima in resonance peak and relative formation cross sections were determined about the negative ions of H^-, D^-, CH_3S^-, CD_3S^-, SH^-, S^-, CH_2^-, CD_2^-, CH^- and CD^-. The dissociation energy of S-H bond and an electron affinity of CH_3S radical were determined as 4.7 ± 0.1 and 3.18 ± 0.2 eV, respectively. (auth)

16832 (JAERI-5030, pp 26-32) RADIATION-INDUCED POLYMERIZATION OF OCTADECYL ACRYLATE MULTILAYERS BY ELECTRON BEAM IRRADIATION. Hatada, M.; Nishii, M.; Hirota, K. Mar 1975.

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Studies have been carried out on the radiation-induced polymerization of octadecyl acrylate (ODA) multilayers built up on a glass plate by Langmuir-Blodgett technique. The ODA multilayers were irradiated with electron beams from a Van de Graaff accelerator (dose rate = 4.3×10^4 rads/sec) either in nitrogen or in air. The effects of irradiation were investigated by multiple reflection infrared spectroscopy, x-ray diffractometry and contact angle measurement. By 0.32 Mrad irradiation in nitrogen atmosphere the multiple reflection infrared spectrum of the ODA multilayers turned mostly into that of poly (ODA) and the ODA multilayers became insoluble in methanol, indicating that the ODA multilayers were polymerized. At the same time the (001) spacing of 29.7A as observed by x-ray diffraction pattern decreased to 28.7A by the irradiation. Further irradiation above 2 Mrad made the polymer multilayer become apparently insoluble in benzene, indicating that the polymer layers were further cross-linked by the irradiation. No indication of polymerization was obtained when the ODA multilayers were irradiated in air. (auth)

16833 (JAERI-5030, pp 33-37) POLYMERIZATION OF VINYL STEARATE MULTILAYERS BY ELECTRON BEAM IRRADIATION. Nishii, M.; Hatada, M. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Studies on the radiation-induced polymerization of vinyl stearate (VST) multilayers were carried out. The VST multilayers built-up on an aluminum plated glass plate by Langmuir-Blodgett technique were irradiated with electron beams from a Van de Graaff electron accelerator in nitrogen atmosphere. The structure of the multilayers and the effects of irradiation were investigated by x-ray diffractometry, contact angle measurement, multi-reflection infrared spectroscopy, and scanning electron microscopy. The VST multilayers became insoluble to methanol by the irradiation, and the multireflection infrared spectrum of the VST multilayers turned into that of poly (VST) with increasing dosage. The polymerization proceeded during the irradiation at the temperature range between −10° and 10°C, and the conversion attained to 90% within 2.5 minutes (total dose, 5.6 Mrads). The multilayers irradiated above 13 Mrads turned into the polymer film insoluble to benzene, indicating that the polymer chains were cross-linked by the irradiation. Stearic acid which was formed by the irradiation of VST at nitrogen-water interface as a hydrolysis product was not detected in this system. (auth)

16834 (JAERI-5030, pp 38-42) RADIATION CHEMICAL REACTION OF METHYL ESTERS OF CARBOXYLIC ACIDS HAVING LONG ALIPHATIC CHAIN. Nagai, S.; Sugimoto, S.; Hatada, M. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

ESR studies have been carried out on the radicals produced by γ-irradiation from methyl laurate (ML) and methyl stearate (MS) in solid and adsorbed states. ML and MS adsorbed on oriented films of Na-montmorillonite gave anisotropic ESR spectra which depend on the angle between the plane of the clay films and magnetic field due to the perpendicular orientation of the main chain of the radicals to the alumino-silicate layers of the clay. Yields of dimers formed from ML and MS in the bulk, adsorbed and multilayer state were determined tentatively by gaschromatographic analysis. It was found that Na-montmorillonite affects favorably the formation of dimers. (auth)

16835 (JAERI-5030, pp 43-47) RADIATION-INDUCED POLYMERIZATION OF 2-HYDROXYETHYL ACRYLATE ADSORBED ON Na MONTMORILLONITE. Sugimoto, S.; Ohnishi, S.; Nitta, I. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

The radiation-initiated polymerization of 2-hydroxyethyl acrylate (HEA) adsorbed on Na montmorillonite has been studied. The HEA complex contained 15.2% of monomer and the difference between the (001) spacing of the dehydrated clay and the complex was 7.8A. The polymer formation in the irradiated HEA complex was determined by thermogravimetry. The rate of polymerization in the clay complex was lower than that of bulk HEA probably due to hindered diffusion of the monomer molecules in the silicate layers. The apparent activation energy of postpolymerization was 23.1 kcal/mole for both the clay complex and bulk HEA. The activation energy of insource polymerization was 21.5 kcal/mole for bulk HEA in the temperature range of −78°C to 80°C, whereas that of the clay complex was found to be −7.8 kcal/mole in the temperature range higher than 30°C. (auth)

16836 (JAERI-5030, pp 48-59) RADIATION-INDUCED GRAFT COPOLYMERIZATION TO POLYESTER. XVII. Grafting of Polyethyleneglycol-Dimethacrylates and -Diacrylates onto Polyethylene Terephthalate Fabric with Electron Beams. Kaji, K.; Okada, T.; Sakurada, I. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

For the purpose of making polyester (polyethylene terephthalate) fabric hydrophilic grafting of polyethyleneglycol-dimethacrylates (PEGMA) and -diacrylates (PEGMA-A) were carried out; the degree of polymerization, n of PEG-block of the PEG-esters were 2, 3, 4, 9, 14 and 23. The fabric was impregnated with aqueous or acetic acid solution of PEGMA or PEGMA-A and irradiated at room temperature with electron beams from a Van de Graaff accelerator for the grafting. Grafting up to 10% was obtained at a dose of 1 to 4Mrad with monomer utilization higher than 90%. Grafting with irradiation in a frozen state at −65°C was also carried out, resulting in nearly the same grafting rate and monomer utilization with that at room temperature. The grafting reaction in a frozen state took place smoothly in the presence of air, while that at room temperature was seriously inhibited with air. Hydrophilic properties of the graft fabrics such as frictional electricity, absorption rate of a water droplet in fabric (wicking test) and moisture regain were measured. Both PEGMA's and PEGMA-A's of n = 14, 23 were effective, wherein PEGMA-A's being more effective, but those of smaller n's exhibited far less effect for the purpose of making polyester hydrophilic. (LK)

16837 (JAERI-5030, pp 60-68) RADIATION-INDUCED GRAFT COPOLYMERIZATION TO POLYESTER. XVIII. Properties of Acrylic Acid- and Methacrylic Acid-Graft Polyethylene Terephthalate Fibers. Okada, T.; Shimano, Y.; Kaji, K.; Sakurada, I. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Properties of polyester (polyethylene terephthalate) fibers grafted with acrylic acid (AA) and methacrylic acid were measured not only in the form of free acid but also in the form of sodium and calcium salts. Nearly the same moisture regain as that of cotton was obtained in the cases of sodium acrylate graft (AA-Na) and methacrylate graft (MAA-Na) at 14 and 18% graft respectively. Although the rate of water droplet absorption by the wicking test revealed that the rate increased with grafting, it is generally lower than that of cotton. Only AA-Na graft showed similar rate as that of cotton at 5% graft. All other grafts (i.e., AA, AA-Ca, MAA and MAA-Na grafts) showed lower rate than cotton even at higher percent graft. Results of frictional electricity test were similar, AA-Na graft showed satisfactory low static charge, whereas the effect of the grafting was insufficient in the cases of AA, MAA and MAA-Na grafts. Polyester fibers above 10% AA graft were dyed homogeneously to deep color with cationic and disperse dyes. AA, AA-Na and AA-Ca grafts showed almost the same dyeability. In the case of MAA grafts, only MAA-Na graft showed good dyeability. Fibers dyed with cationic dyes showed poor light fastness. No or very little change in tensile properties of polyester fibers were observed upon grafting of acrylic acid. However, strength and modulus of grafts decrease when AA grafts above 15% graft were converted to AA-Na by treatment in aqueous sodium bicarbonate solution. (auth)

16838 (JAERI-5030, pp 69-76) RADIATION-INDUCED GRAFT COPOLYMERIZATION TO POLYESTER. XIX. Resistivity of Polyethylene Terephthalate Fibers Grafted with Hydrophilic Monomers to Alkaline Media. Sakurada, I.; Okada, T.; Kaji, K.; Tsuchiya, A. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Resistivity of polyethylene terephthalate (PET) fibers grafted with various hydrophilic monomers to alkaline media was tested by treating the graft fibers in boiling 1% aqueous sodium carbonate for 4 hr. The higher the percent weight loss of the fiber by the treatment the lower the resistivity. The results are as follows: (a) Two types of fibers which have been grafted with acrylic acid are compared; one is grafted rather homogeneously and thoroughly (by microscopic observation of cross section of the dyed fiber) and the other is grafted only peripherally (showing colored ring in cross section). It is noteworthy that the two fibers show practically no difference in the alkali-resistivity. When the percent apparent graft is 5%, the weight loss exceeds 30%. (b) Neither cross linking of polyacrylic acid grafted on PET by irradiation with γ-rays nor additional grafting with hydrophobic monomers improved the alkali-sensitivity of the graft fibers. (c) PET fiber grafted with methacrylic acid shows almost the same low resistivity as fiber grafted with acrylic acid. Behavior of vinylpyrrolidone is not far different from that of acrylic or methacrylic acid. (d) The decrease of the alkali-sensitivity of PET fiber by grafting of 4-vinyl pyridine is very small. The graft fibers may be regarded to be alkali-insensitive. (e) PET fibers grafted with monomethacrylates of ethylene- and polyethylene-glycols show higher alkali-resistivity than fibers grafted with acrylic acid. (f) PET fibers grafted with diacrylates and dimethacrylates of polyethylene glycols show good resistivity to alkaline media. Due to large molecular size of these monomers and cross-linking during the reaction, the apparent grafting takes place only on the surface of the fibers. Taking into account the experimental results of Schamberg, it may be concluded that the decrease in the alkali-resistivity of PET grafted with acidic monomers is attributed to such a structure change of PET matrix that alkali can easily penetrate into the matrix to hydrolyze PET. (auth)

16839 (JAERI-5030, pp 77-84) RADIATION-INDUCED POLYMERIZATION OF POLYETHYLENEGLYCOL DIMETHACRYLATES WITH ELECTRON BEAMS. Okada, T.; Kaji, K. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Radiation-induced polymerization of polyethyleneglycol dimethacrylates (PEGMA) has been studied using electron beams from a Van de Graaff accelerator; the degrees of polymerization, n's of PEG block of the dimethacrylates were 1, 4, 9, 14 and 23. Irradiations of PEGMA were carried out either in a liquid thin layer at 23°C or in a frozen state at −65°C. The polymerization of PEGMA (n = 14) took place readily to form cross-linked polymer and the monomer conversion up to 98% was observed at a dose of 1Mrad. The rate of double-bond disappearance in PEGMA with irradiation was measured by the use of an infrared spectrometer. The rate increased with increasing degree of polymerization of PEG block in the dimethacrylates. However, the G-values of double-bond disappearance were nearly independent of the molecular weight of the dimethacrylates. This may be explained by the relation that larger molecular weight corresponds to smaller concentration of double-bond. The G-value of double-bond disappearance for the dimethacrylates at a dose rate of 0.16Mrad/sec was about 2000, which was several ten times larger than that of monomer disappearance by the polymerization of vinyl monomer such as methylmethacrylate and styrene. It was found that polymerization of PEGMA (n = 14) proceeded in a frozen state at −65°C at nearly the same rate with that at 23°C, resulting in cross-linked polymer. The degree of double-bond disappearance in PEGMA (n = 9, 14) reached a value of 98% with irradiation of about 2Mrad in a frozen state at −65°C as well as in a liquid state at 23°C. The presence of spherulite-like structure was observed by the use of a microscope in PEGMA (n = 14) polymerized. The PEGMA (n = 14) polymer thus obtained has tensile strength twice as high as that of the polymer obtained at 23°C. (auth)

16840 (JAERI-5030, pp 85-91) RADIATION CURING OF MIXTURES OF DIALLYLPHTHALATE PREPOLYMER AND VINYL MONOMER. IX. Fundamental Examination of the Application of Low Molecular Weight Diallylphthalate Prepolymer. Gotoda, M.; Kitada, Y. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Radiation curing, mainly by electron beams was studied with mixtures of low molecular weight diallylphthalate prepolymer (DAPp · L) and vinyl monomers with special reference to their workability. Among vinyl monomers, acrylonitrile gave a solution of low viscosity and methyl acrylate gave a solution of low dose curing. Radiation curing of DAPp · L/vinyl monomer mixtures impregnated in wood was also tried. To obtain uniform wood-polymer composites, γ-irradiation after impregnation at 10kg/cm^2 was found to be required for thick plate (110mm), while electron beam irradiation after impregnation at normal pressure was sufficient for thin plate. (auth)

16841 (JAERI-5030, pp 92-102) RADIATION CURING OF MIXTURE OF DIALLYLPHTHALATE PREPOLYMER AND VINYL MONOMER. X. Application of Electron Beam Curing of Low Molecular Weight Diallylphthalate Prepolymer/Vinyl Monomer Mixtures to the Preparation of American Hemlock-Polymer Composites Piled Board. Part 1. Thermal Curing. Gotoda, M.; Harada, O.; Yagi, T.; Yoshizawa, I. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Preparation of Wood-Polymer Composite (WPC) piled plywood for flooring use, was attempted by electron beam irradiation of thin veneer, impregnated with low molecular weight Diallylphthalate prepolymer (DAPp-L)/vinyl monomer mixtures. In this connection, thermal curing of DAPp-L/methyl acrylate/hydroxyethyl acrylate/benzoyl peroxide (50/40/10/2), impregnated in American hemlock veneer, was studied for the comparison with the electron beam curing. Hot water or organic solvent (ethanol/benzene) extraction of the wood, prior to the impregnation, was found to be effective to improve the uneven impregnation of the resin mixture, which is due to the heterogeneity of the wooden tissue of American hemlock. Curing was achieved in a short duration, i.e., several minutes, under rather high temperatures, such as 130°C. Prolonged curing makes the resin in wood harder and so the prepared WPC piled board became less resistant to the hot and cold cycle test. Addition of small amount of polyvinylacetate to the resin mixture increased the resistance of the WPC piled board to that test. Among other improvements obtained were surface hardness, abrasion resistance, and shock resistance, as compared to those of untreated one. (auth)

16842 (JAERI-5030, pp 103-113) RADIATION CURING OF MIXTURE OF DIALLYLPHTHALATE PREPOLYMER AND VINYL MONOMER. XI. Application of Electron Beam Curing of Low Molecular Weight Diallylphthalate Prepolymer/Vinyl Monomer Mixtures to the Preparation of American Hemlock-Polymer Composites Piled Board. Part 2. Electron Beam Curing. Gotoda, M.; Okugawa, H.; Yagi, T.; Yoshizawa, I. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Preparation of Wood-Polymer Composite (WPC) piled plywood for flooring, was attempted by electron beam irradiation of American Hemlock veneer, impregnated with low molecular weight diallylphthalate prepolymer (DAPp · L)/vinyl monomer mixtures, in comparison with that by thermal curing reported previously. For the improvement of the mechanical properties of WPC piled plywood, 5 ~ 15 parts of low molecular weight polyvinylacetate (PVAc) was added to DAPp · L/methyl acrylate/hydroxyethyl acrylate/benzoyl peroxide (50/40/10/2) mixture. The addition of PVAc did not give much influence to the degree of impregnation in the veneer and to the curability by electron beam irradiation. As to the resistance to hot and cold cycle test, WPC piled plywood, prepared by the resin containing 5 parts of PVAc gave the best results. As a general conclusion, due to the superior mechanical properties, the WPC piled plywood processed by electron beam irradiation is suitable for flooring use. (auth)

16843 (JAERI-5030, pp 114-124) RADIATION CURING OF TRIALLYLISOCYANURATE PREPOLYMER/VINYL MONOMER MIXTURES. II. Studies on Suitable Compositions for Electron Beam Curing and their Application to Coatings on Wooden Materials. Gotoda, M.; Okugawa, H.; Yagi, T. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

The electron beam curing of mixtures (1/1) of prepolymer and vinyl monomer was studied, as a continuation from the previous study. The prepolymers used were chlorinated triallylisocyanurate prepolymer (TAICp(Cl), $\overline{Mn}$ = 3,700) and several kinds of triallylisocyanurate prepolymers (TAICp) with different molecular weights ($\overline{Mn}$ = 5,500 ~ 9,000) and chemical structures. The monomers used were methyl acrylate (MA) and methyl methacrylate (MMA), and Acrylonitrile (AN), etc. Among them, AN gave a mixture of the lowest viscosity. Mixtures of the prepolymers containing MA were more curable than those containing MMA, being less dose rate dependent. It was also found that in MA system, the consumption of the monomer and the sol took place in parallel during curing process, while the former preceded the latter in MMA system. The mixtures containing TAICp(Cl) were of lower viscosity and cured more easily than

those containing TAICp. On the other hand, the curability of the latter mixture was independent of molecular weight of the prepolymer but dependent on the chemical structure. For the curing of these mixtures (1/1), the presence of air did not affect the curability and the surface hardness. The particle board coated with a mixture of TAICp(Cl)/MA/trimethylolpropanetrimethacrylate/TiO_2(50/40/10/20) exhibited the excellent surface hardness equivalent to that of decorative melamine resin laminated board. (auth)

16844 (JAERI-5030, pp 125-135) RADIATION CURING OF EPOXY-ACRYLATE PREPOLYMERS AND THEIR MIXTURES WITH VINYL MONOMERS. III. A Survey on Low Vapor Pressure Vinyl Monomers, Suitable for Use in Electron Beam Curable Coating Compositions. Gotoda, M.; Miyashita, Y.; Takeyama, K. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

A study on electron beam curing of epoxy-acrylate prepolymer was carried out in the mixtures containing vinyl monomer of low vapor pressure, the use of which is almost essential for the present day practical application. Viscosity of the mixture, its electron beam curability and performance of the cured coatings on steel panel were examined for 70/30 or 65/35 mixture of bisphenol A type epoxy-acrylate of two different $\overline{Mn}$, 520 (RE-1) and 1,120 (RE-2), and one of 40 different vinyl monomers. The coatings containing RE-1 were resistant to immersion in salt water but poor in adherence, and vice versa for the coatings containing RE-2. The curability was excellent in the combinations of RE-1/acrylic ester and RE-2/methacrylic ester. However, flexibility of the coatings was still not satisfactory in general. Therefore, together with other problems, further studies are required for the practical application of the compositions. (auth)

16845 (JAERI-5030, pp 136-142) RADIATION CURING OF EPOXY-ACRYLATE PREPOLYMERS AND THEIR MIXTURES WITH VINYL MONOMERS. IV. Effects of Addition of Pigments to Epoxy-Acrylate/Vinyl Monomer Mixtures Upon the Electron Beam Curing of Their Coatings on Steel. Gotoda, M.; Miyashita, Y.; Mori, K. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973–March 31, 1974.

Several coatings, cured by electron beams, were prepared with the mixtures of epoxy-acrylate, vinyl monomer and various pigments. Anticorrosive tests were carried out in order to find suitable pigments for the purpose. A mixture of bisphenol A type epoxy-acrylate ($\overline{Mn}$ = 520) and 2-hydroxypropyl methacrylate (52/48) was chosen as a coating vehicle. Three types of iron oxide and two types of zinc chromate were used as pigments. Doses required for curing, hardness and adherence of the cured coatings didn't differ so much from those of pigmented ones (20%). Viscosities of the paints became slightly higher when iron oxide pigments were added, while the viscosities markedly increased when zinc chromate pigments were used. Some coatings showed excellent resistance to salt water immersion with test specimens scratched crosswise on the surface. The stability in storage decreased for the paints containing zinc chromate pigments in the presence of acrylic acid in the vehicle. Red iron oxide was generally found to be the most suitable among the pigments tested. (auth)

16846 (JAERI-M-5895) SIMULTANEOUS STABILIZATION-POLYMERIZATION OF TETRAOXANE. Nakase, Y.; Yoshida, M.; Sakamoto, M.; Ito, A. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 60p. (In Japanese). INIS. NTIS (US Sales Only) $6.00.

The simultaneous stabilization-polymerization, without any additional stabilization process to obtain thermally stable polyoxymethylene, is described. Tetraoxane is thus polymerized in the presence of a cyclic acetal and/or cyclic acetal with molecular halogen or hydrocarbon halide as the polymerization initiator. Polymerization in the solid state gives better results than in the liquid state. A method for producing the polymer with good thermal stability and suitable molecular weight is established, i.e., when tetraoxane is polymerized in the presence of both methylal and 1, 3-dioxolane at 105 to 110°C with iodone or methyl iodide as the initiator; the product is practically useful polyoxymethylene. The acceleration of polymerization by irradiation is significant, similarly to the case when no acetal is existent in the system. Where concentration of the initiator is low, the synergistic effect of initiator and ionizing radiation in the polymerization is observed. Formic acid, formaldehyde, etc., which often exist in the system, lower the rate of polymerization and thermal stability of the polymer. (auth)

16847 STABILIZATION AND CLARIFICATION OF SECTIONS MOUNTED ON FORMVAR-COATED SLOT GRIDS BY DELIBERATE IRRADIATION IN THE ELECTRON BEAM. Yang, G. C. H.; Morrison, A. B. (New Jersey Coll. of Medicine, Jersey City). J. Microsc. (Oxford).; 103: 187-194(Mar 1975).

Epon-Araldite sections supported on Formvar-coated slot grids can be stabilized by exposing the area of interest in the column of the electron microscope to irradiation of 0.5 C/cm^2. With this procedure electron micrographs of high quality can be obtained without drift or distortion, from any part of the open slot area. After treatment the support film is not only stable and transparent but robust enough to permit repeated removal and replacement of the specimen in the microscope column. The method is illustrated with a series of electron micrographs with initial magnifications ranging from ×300 to × 500,000 to show the quality of image that can be achieved. The effect of the irradiation on tissue architecture is checked by resectioning the irradiated sections. This method of local irradiation of sections is recommended for investigations using low or intermediate magnifications for the wide field it permits, for the durability it confers on the specimen and for its convenience. (auth)

16848 THERMAL STABILITY OF γ-IRRADIATED FLUOROELASTOMERS. Cuccuru, A.; Sodi, F. (Laboratorio di Radioprotezione, Pisa, Italy). Thermochim. Acta.; 12: No. 3, 281-286(Jul 1975).

The thermal stability of five hydrofluoroelastomers, irradiated up to 50 Mrad by γ rays in the hot cell of the reactor "G. Galilei" was investigated by thermogravimetric analysis. The apparent activation energy and the order of reaction for the degradation were evaluated by the Flynn and Wall method. The results show a noteworthy decrease in the thermal stability of the irradiated elastomers. (NL)

16849 INCREASING THE CATALYTIC ACTIVITY OF ZINC, CADMIUM, AND LEAD SULFIDES BY GAMMA IRRADIATION. Kalamazov, R. U.; Korshunova, G. D. (Inst. of Nuclear Physics, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 11, 30-31(1974). (In Russian).

The decomposition of isopropyl alcohol was followed kinetically on an adsorbed layer of Zn, Cd or Pb sulfide which had been subjected to various thermal treatments, and combined thermal and radiation treatments. Heating of PbS to 200°C, CdS to 400°C and ZnS at 600°C leads to a minimum increase of catalytic activity with an increase in width of the forbidden zone of the semiconductor. The sulfide surface contains potential catalytic centers which can be activated either by thermal or radiation treatment for decomposing alcohol molecules with the formation of acetone and hydrogen. Catalytic activity is highest for gamma-irradiated zinc sulfide subjected to thermal activation at 600°C. Irradiated CdS thermally activated at 400°C also shows good catalytic activity. (SJR).

16850 RADIOLYSIS OF TBP SOLUTIONS IN CONTACT WITH NITRIC ACID. II. Oxidation and Nitration Processes. Barelko, E. V.; Solyanina, I. P. At. Energ. (USSR); 38: No. 1, 23-26(Jan 1975). (In Russian).

The regularities of nitration and oxidation reactions in a 25% TBP + syntin + 3M HNO_3 system have been investigated. The effect of oxygen on the yields of radiolysis products is shown. In going from a solution not containing oxygen to a solution in equilibrium with 1 atm. of O_2, the yield of oxygen containing products of radiolysis increases from 0.2 to 1.2 mol/100 eV, and the yield of (RNO_2 + RNO) drops from 1.6 to 0.1 mol/100 eV. This explains a number of discrepancies in the yield data of other authors. It is suggested that not only hydrocarbon but also TBP takes part in radioactive nitration. (auth)

16851 SCALE-UP PRODUCTION OF BAGASSE PLASTIC COMBINATIONS BY USE OF GAMMA RADIATION. Wang, U. P. (Industrial Technology Research Inst., Hsinchu, Taiwan). Nucl. Sci. J. (Taiwan); 12: No. 1, 12-22(Mar 1975).

A scale-up production of the bagasse plastic combinations (BPC) by gamma radiation process has been investigated and discussed. The results of radiation-induced in situ polymerization of vinyl monomers in Taiwan Sugar Corp. made bagasse board was recognized to be in good agreement with those of research work reported earlier. The polymerization-heat evolved during gamma irradiation was thoroughly investigated and analyzed. The mechanical and other properties of the BPC product were found to be greatly improved. The economic evaluation reveals that monomer price exerts the biggest effect on the total manufacture cost of BPC. (auth)

16852 PULSE RADIOLYTIC INVESTIGATION OF THE REDUCTION OF CADMIUM(II) IONS. Kelm, M.; Lilie, J.; Henglein, A. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Chem. Soc. (London), Faraday Trans., I.; 71: 1132-1142(1975).

In γ-irradiated aqueous $CdSO_4$ solutions containing alcohols or formate ions, the hydrated electron reacts with Cd^{2+} to form Cd^{+}

and the OH and H radicals react with the organic solute to form organic free radicals. The 100-eV yield of metallic cadmium was 2.5 in the presence of formate and close to zero in the presence of t-butanol and in the absence of organic additives. In the presence of other alcohols, the highest yield observed was with methanol [G(Cd) = 1.3] and the lowest with propan-2-ol (G = 0.4). Pulse radiolytic studies with optical absorption, conductimetric and light scattering techniques for detection of intermediates yielded the following results: Cd^+ is oxidized by the radical $CH_3(CH_3)_2COH$. α-Alcohol radicals react with Cd^+ ions to form products that hydrolyze in the millisecond time scale to regenerate Cd^{2+}. The reaction $2Cd^+ \rightarrow Cd_2^{2+}$ ($2k = 3.0 \times 10^9$ dm^3 mol^{-1} s^{-1}) is responsible for the formation of metallic cadmium. The rate constants for the reactions of Cd^+ with OH and various organic radicals and the absorption spectra of Cd^+ and Cd_2^{2+} were also determined. During the first few seconds of the disappearance of Cd_2^{2+}, small agglomerates of cadmium that scatter uv radiation are formed. Further agglomeration to produce colloidal particles that scatter 514.5 nm laser light occurs within a few minutes after the high energy electron pulse. Scattering measurements were also carried out with irradiated Ni^{2+} solutions. The mechanism for colloidal nickel formation was found to be different from that for colloidal cadmium formation. (auth)

16853 SOME REACTIONS OF THE HYDROXYL ADDUCT OF ADENINE. van Hemmen, J. J. (Rijksverdedigingsorganisatie TNO, Rijswijk). Int. J. Radiat. Biol.; 27: No. 4, 403-407(Apr 1975).

Transient absorption spectra obtained after pulse-radiolysis of aqueous solutions of adenine gave evidence for the reactions of the hydroxyl adduct of adenine, and one of these reactions was compared with similar reactions of hydroxyl adducts of other purine derivatives. The results demonstrated that, in various purine derivatives, the opening of the imidazole ring under the influence of radiation is due to the unimolecular rearrangements of the hydroxyl adducts of these purines. An exception was the hydroxyl adduct of the parent compound, purine, the decay of which followed strict second-order kinetics. The rearranged hydroxyl adducts of the purine derivatives probably react with suitable proton donating species to produce the 5-formamidopyrimidines known to be formed by radiolysis. A study of the absorption spectra obtained 100 μsec after pulse-irradiating an adenine solution in the presence and absence of oxygen demonstrated that oxygen reacts with an adenine radical. This observation may be significant for radiobiology. (UK)

16854 COMPARISON OF RADIOLYSIS PRODUCTS OF THYMINE AND THYMIDINE WITH ESR RESULTS. Teoule, R.; Cadet, J. (CEN, Grenoble, France). Int. J. Radiat. Biol.; 27: No. 3, 211-222(Mar 1975).

Radicals determined by ESR spectrometry of irradiated thymine or thymidine and radiolytic products generated under the action of gamma rays in aerated aqueous solutions were compared. This comparison lay mainly in the fact that a radical R· gave rapidly the corresponding peroxide ROOH. Twenty peroxides were isolated and characterized, i.e., the four isomers cis (–), cis (+), trans (–), trans (+) of 6-hydroperoxy-5-hydroxy-5,6-dihydrothymidine; the four isomers cis (–), cis (+), trans (–), trans (+) of 5-hydroperoxy-6-hydroxy-5,6-dihydrothymidine; 5-hydroperoxy-2′-deoxyuridin; cis and trans 6-hydroperoxy-5-hydroxy-5,6-dihydrothymine; cis and trans 5-hydroperoxy-6-hydroxy-5,6-dihydrothymine; 5-hydroperoxymethyl-uracil; 5-hydroperoxy-5,6-dihydrothymine; cis and trans 6-hydroperoxy-5,6-dihydrothymine; 5-hydroperoxy-5-methyl barbituric acid; 5-hydroperoxy-5-methyl hydantoin; trans 5,6-dihydroperoxy-5,6-dihydrothymine. Most of the thymine and thymidine radicals hypothesized or described in the literature were correlated to these peroxides. However, the presence of certain peroxides could not be explained by recognized radicals. Taking advantage of this fact, the existence of new thymine or thymidine radicals so far unknown could be predicted. (auth)

16855 AN ESR STUDY OF IRRADIATED N-ACETYL-L-ALANINE AT 295 K. Saxeboel, G. (Oslo Univ., Norway). Int. J. Radiat. Biol.; 27: No. 3, 293-296(Mar 1975).

ESR studies on irradiated amino acids and peptides in the crystalline state give important information about radiation damage in proteins. Single crystals of N-acetyl-L-alanine were grown from both H_2O and D_2O solutions, and then irradiated with 4.0 MeV electrons to a total dose of approximately 10 Mrads. Studies of the ESR spectra subsequently obtained from the crystals at room temperature indicated that the radical in N-acetyl-L-alanine is $H_3C\dot{C}HCOOH$, formed by a secondary deamination reaction. Possible mechanisms for the formation of the radical are discussed. This radical contrasts with the "backbone" radical $H_3CCONH\dot{C}(CH_3)COOH$ identified in N-acetyl-DL-alanine (Katayama, M., 1962, J. molec. Spectrosc., 9, 429). These results together with Katayama's indicated that the secondary radical reactions in the solid state may be strongly influenced by the crystalline field. (UK)

16856 ELECTRON SPIN RESONANCE OF FREE RADICALS, V-CENTERS, AND ELECTRONS TRAPPED IN IRRADIATED CRYSTALS OF ADENINE HYDROCHLORIDES. Huettermann, J. (Univ., Regensburg, Ger.). J. Magn. Resonance; 17: No. 1, 66-88(1975).

The formation and structure of paramagnetic species in irradiated mono- and dihydrohalide crystals of the nucleic acid purine base adenine was investigated by means of ESR spectroscopy between 77°K and room temperature. Two radicals from the adenine molecule were observed. One is assigned to the adenine anion. The other is of the type R_α-N-CH_2-R_β located on $N_{(7)}$ of the imidazole ring. (auth)

16857 STUDY OF AMORPHOUS PHASES IN POLYETHYLENE BY RADIOTHERMOLUMINESCENCE. Aulov, V. A.; Sukhov, F. F.; Slovokhotova, N. A.; Bakeev, N. F. (Scientific-Research Inst. of Physical-Chemistry, Moscow). Vysokomol. Soedin., Ser. B; 17: No. 3, 198-201(Mar 1975). (In Russian).

To determine the difference in molecular mobility in polymers due to heterogeneity of disordered fields, radiothermoluminescence (RTL) studies were made on iodine penetration of low-density polyethylene films. The 100-mm-thick films were placed over iodine crystals for definite times and then irradiated in liquid nitrogen. The introduction of iodine into the polymer changed the shape of the RTL curve, with the change occurring at different rates at different temperatures. The iodine apparently enables destruction, at 200°K, of the charges in the irradiated polyethylene. The data indicate that the shape of the RTL curve depends on the presence and state of amorphous regions in partly crystallized polymers and that introduction of iodine into the polyethylene causes a relaxation transition around 200°K. The discrete relaxation transition apparently corresponds to different parts of the amorphous polyethylene phase, which differ in the characteristic thawing out of molecular mobility when the polymer is heated. (TTT)

16858 RADIATION POLYMERIZATION IN BINARY CRYSTALLINE SYSTEMS. Yakovleva, M. K.; Nekhoroshev, V. G.; Sheinker, A. P.; Abkin, A. D. (Scientific-Research Inst. of Physical-Chemistry, Moscow). Vysokomol. Soedin., Ser. B; 17: No. 3, 212-214(Mar 1975). (In Russian).

To determine the reason for the sharp increase in the rate of solid phase polymerization of polycrystalline acrylamide caused by adding ice, benzoic acid, dimethyl sulfoxide, or acetamide crystals, the nature and behavior of the active parts formed in the acrylamide-additive binary systems upon irradiation were studied by EPR. The polymerization apparently takes place chiefly at the surface of the eutectic crystalline system. The nonpolymerizing additive reacts with the monomer, predetermining the eutectic structure of the crystals on whose surfaces the polymerization occurs. (TTT)

16859 EFFECT OF HIGH ENERGY RADIATIONS ON THE FLOTABILITY OF MINERALS. Sen, P. K.; Roy, S. (Jadavpur Univ., Calcutta). J. Inst. Eng. (India); 55: No. 1, 1-4(Nov 1974).

A large number of studies have been devoted to the improvement of flotabilities of minerals by using high-energy radiations. High-energy radiations may be practised on dry or wet minerals but irradiating a mineral pulp is more advantageous from operational point of view. The nature of irradiations chosen is of importance. Ionizing radiations (γ-rays, β-rays, etc) as well as non-ionizing (neutron) radiation have been used but γ-rays appear to be superior from a practical point of view. Direct irradiation of solids results in change of Fermi-level of the minerals and this in turn affects adsorption behavior of the collector at the surface. The effects of pulp irradiation depend on several operational factors such as pH of the solution, and dissolved oxygen concentration of the pulp. Depending on these factors, either an oxidizing or a reducing condition may be created within the pulp. This in turn affects the electron distribution of the surface and hence the adsorption of the collector on the surface. Collector irradiation results in more complicated reactions in which the form of the collector originally used changes affecting the flotation behavior. This paper points to the necessity of further experimentation in utilizing the theoretical aspects presented in the paper. (auth)

16860 ONE-ELECTRON TRANSFER EQUILIBRIA AND REDOX POTENTIALS OF RADICALS STUDIED BY PULSE RADIOLYSIS. Meisel, D. (Carnegie-Mellon Univ., Pittsburgh); Czapski, G. J. Phys. Chem.; 79: No. 15, 1503-1509(17 Jul 1975).

The pulse radiolysis technique is utilized for measurements of the equilibrium constants for electron transfer between the durosemiquinone radical anion and oxygen, menadione, and indigodisulfonate. These equilibrium constants are in turn used for cal-

culations of one-electron redox potentials for these systems. Each of these equilibrium constants was determined experimentally and independently and found to be self-consistent. Only for the reactions of the semiquinone radical ions with oxygen could the electron transfer reaction be followed directly. For the reactions between the various quinone-semiquinone systems substantial indirect evidence is presented that these equilibria are achieved rapidly. In those cases equilibrium constants were determined from studies of the effect of quinone concentrations on the relative yields of the semiquinones. A method for distinguishing between kinetic competition and equilibrium is outlined and its usefulness is emphasized. The $DQ|DQ^-$ (DQ = duroquinone) and $IDS|IDS^-$ (IDS = indigodisulfonate) systems were employed as reference couples as the redox potentials for those systems are either available in the literature ($IDS|IDS^-$) or may be calculated from available data ($DQ|DQ^-$). Taking $E_{\frac{1}{2}}$, the redox potential for the first one-electron reduction step at pH 7, of $DQ|DQ^-$ as -0.235 V or of $IDS|IDS^-$ as -0.247 V both yield $E_{\frac{1}{2}} = -0.325$ V for the $O_2|O_2^-$ system (1 atm of O_2) and $E_{\frac{1}{2}} = -0.20$ V for the menadione system. (auth)

16861 IONIC AGGREGATION OF THE SOLVATED ELECTRON WITH LITHIUM CATION IN TETRAHYDROFURAN SOLUTION. Brockrath, B.; Dorfman, L. M. (Ohio State Univ., Columbus). J. Phys. Chem.; 79: No. 15, 1509-1512(17 Jul 1975).

Aggregation of the solvated electron with lithium cation in tetrahydrofuran forms an ion pair investigated by the pulse radiolysis method. The ion pair (Li^+, e_s^-) has a near-infrared absorption band with λ_{max} 1180 nm and a molar extinction coefficient of 2.28×10^4 M^{-1} cm^{-1} at the maximum. Absolute rate constants were determined for reactions of this species with anthracene, biphenyl, and dibenzylmercury. These reactivities are compared with the reactivities of (Na^+,e_s^-) and e_s^- in THF solution. (auth)

16862 RADIATION-INDUCED IONIC POLYMERIZATION OF ALPHA-METHYLSTYRENE: AN APPLICATION OF THE HITTORF METHOD. Katayama, M.; Ushimaru, S. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). Chem. Lett. (Tokyo); No. 7, 769-772(Jul 1974).

The radiation-induced ionic polymerization of α-methylstyrene has been studied by means of the Hittorf type conductivity measurement. For extremely dry samples it has been estimated that the chain transfer to monomer is about 10^5. It was concluded that freely moving electrons play an important role in the polymerization. (auth)

16863 ELECTRON SPIN RESONANCE STUDIES ON IRRADIATED POLY(VINYLIDENE FLUORIDE). Seguchi, T.; Makuuchi, K.; Suwa, T.; Tamura, N.; Abe, T. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). Nippon Kagaku Kaishi; 1974: No. 7, 1309-1314(Jul 1974). (In Japanese).

The radical species trapped in irradiated poly(vinylidene fluoride) (PVdF) were assigned by electron spin resonance (ESR). The films of PVdF were drawn by 400% at 45°C. The samples thus obtained had a crystal structure of the zigzag chain conformation, where the chains were aligned parallel to the drawing direction. The samples, which were sealed in ESR sample tube and evacuated, were irradiated with γ-rays from ^{60}Co at 77°K. The ESR spectra were recorded at 77°K and room temperature. The ESR spectra obtained at 77°K after irradiation showed a broad and diffuse pattern with several shoulders. After the sample was annealed at room temperature for an hour, a resoluble pattern consisting of a double sextet appeared. The radical responsible for the double sextet was assigned to the alkyl-type radical, $-CH_2-\dot{C}F-CH_2-$, and the conformation was presumed. Upon annealing at 195°K after irradiation, the chain scission radical, $-CH_2-\dot{C}F_2$, was observed as a small portion of the trapped radicals. When the sample irradiated at 77°K was stored for a long time at room temperature or annealed for a short time at high temperature in vacuo, the singlet spectrum remained. The singlet was stable in vacuo and was assigned to polyenyl radicals, $-(CF=CH)-\dot{C}H-$. The alkyl-type radicals and polyenyl radical easily reacted with oxygen to form peroxy radicals. Oxygen molecules diffused into the crystalline regions and reacted with the trapped radicals. Therefore, when irradiation was performed in air at low dose rate, these radicals were converted into peroxy radicals, which hindered the crosslinking reaction. The stability of the alkyl-type radicals and the reactivity with oxygen had relations to crosslinking and degradation. (auth)

16864 OXIDATION OF Fe^{2+} AND REDUCTION OF Ce^{4+} IN AQUEOUS SOLUTIONS BY THE ACTION ULTRASONICS. Sakai, Y.; Sadaoka, Y.; Takamuru, Y. (Ehime Univ., Matsuyama (Japan). Faculty of Engineering). Nippon Kagaku Kaishi; 1974: No. 7, 1166-1169(Jul 1974). (In Japanese).

The effects of the ultrasound on the oxidation of Fe^{2+} and reduction of Ce^{4+} in 0.8 N sulfuric acid solutions were investigated. The ultrasonics of 400 kHz was found to be more effective than that of 29 kHz. The rate of oxidation of Fe^{2+} increased with increasing its initial concentration up to 10^{-3} mol/l and at the concentration reached the saturation value. The rate of reduction of Ce^{4+} was independent of its initial concentration. As optimum power output was found in the oxidation of Fe^{2+}, while in the reduction of Ce^{4+} the reaction rate was proportional to the power output. The ratio of the yield of Fe^{3+} to that of Ce^{3+} at a given power output was 1.17. This value is much closer to the ratio of the G values of the same reactions with α irradiation, $G(Fe^{3+})/G(Ce^{3+}) = 1.43$, than to that with γ rays, $G(Fe^{3+})/G(Ce^{3+}) = 6.33$. (auth)

16865 POSITRON AS A PROBE OF CATION VACANCIES IN X-IRRADIATED NaBr CRYSTALS. Annenkov, Yu. M.; Arefiev, K. I.; Frangulyan, T. S.; Starodubov, V. G.; Vorobiev, S. A. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). Appl. Phys.; 7: No. 1, 83-84(May 1975).

2 figs.; 13 refs.

The temperature dependence of the ionic conductivity shows an increase of the free-cation vacancies concentration in x-irradiated NaBr single crystals. The 2 γ angular correlation measurements confirm that positron bound states are formed preferably near the cation vacancies. (auth)

16866 PROCESS FOR PRODUCING A DIARYL PHTHALATE PREPOLYMER. Yamamichi, K.; Kodama, T. (to Osaka Soda Co. Ltd. (Japan)). Japanese Patent 1973-44958/B/. 7 Nov 1970. 4p. (In Japanese).

A process for producing a diaryl phthalate prepolymer is provided by supplying the prepolymer with activated oxygen to improve the working, rapid hardening and heat resisting properties of the prepolymer. The process consists of two procedures. The first procedure is characterized by irradiating ortho- or isodiaryl phthalate prepolymer in the form of powder with ionizing radiations in the presence of oxygen. The second procedure is characterized, in the procedure according to the first method, by the humidification of the prepolymer with an alcohol containing tertiary hydrogen in the form of liquid at room temperature. In embodiments, the ionizing radiations may be gamma rays, electron beams, x rays, and the like, with an absorption dose of from 0.07 to 16 Mrad at a dose rate of from 0.4×10^4 to 1.6×10^6 rad/sec. The process may be carried out at room temperature. Diaryl orthophthalate prepolymer having an iodine value of 57, a viscosity of 97cp measured by a 50% methylethyl keton solution, 0.0009% by weight of activated oxygen and a particle size of 80 mesh was irradiated with gamma-rays at various dose rates in the air at 25°C for 16 hrs. (JA)

16867 CHEMICAL NUCLEAR REACTOR AND ECONOMY OF HYDROGEN. Danno, A. (Japan Atomic Energy Research Inst., Tokyo. Radioisotope School). Kagaku Keizai; 21: No. 9, 40-49 (Sep 1974). (In Japanese).

In the face of an increasingly serious energy crisis, the utilization of atomic energy is inevitable, but it is necessary to develop the more efficient method of utilization. Recently, the method of converting the kinetic energy of nuclear fission fragments directly to chemical energy by utilizing nuclear chemical reaction has received attention. This method utilizes nuclear reactors as the radiation source; atomic energy can be utilized efficiently. Such reactors are called chemical nuclear reactor, and it is very important to select the appropriate reaction system. The utilization of hydrogen as a new fuel is important in view of fuel resources and environmental pollution. The production of hydrogen by using nuclear reactors has been proposed recently. As for the production process, there are the radiolysis of water, the radiolysis of hydrocarbons, and the combination of the radiolysis of carbon dioxide and water gas reaction. Water homogeneous reactors, such as water-boiler type experimental reactor, are the ideal chemical nuclear reactors for the production of hydrogen. The problem in the radiolysis of carbon dioxide is the accumulation of radioactive CO_2, and the addition of propane or propylene is effective for its prevention. The flow sheet for the chemical nuclear reactor for the CO_2 radiolysis and hydrogen generation is presented, and the quantity of hydrogen generated with a 100-MW chemical nuclear reactor is estimated as 4×10^3 m^3/hr. (JA)

16868 RADIOLYSIS OF TITANIUM POTASSIUM OXALATE IN AQUEOUS SOLUTION. Bundo, Y.; Ono, I. (Industrial Research Inst. of Kanagawa Prefecture, Yokohama (Japan)); Ogawa, T. Radioisotopes (Tokyo); 23: No. 9, 493-497(Sep 1974). (In Japanese).

The dissolving state of titanium potassium oxalate in aqueous solution depends on pH value. The structure of the yellow-brown titanic complex, produced by the reaction between titanium potassium oxalate and hydrogen peroxide also depends on pH value. From these facts, titanium potassium oxalate sample solu-

tion was prepared by dissolving in distilled water. The relation between radiation dose and yield of titanic complex was obtained by γ-irradiation of the sample solution saturated with oxygen or nitrogen gas. From these experimental results, the production mechanism of hydrogen peroxide was possible to presume. The reaction velocity between OH radical and titanium potassium oxalate was $2.9 \times 10^{10} M^{-1} \cdot sec^{-1}$. (auth)

16869 PRIMARY STEPS IN THE REACTIONS OF ORGANIC DISULFIDES WITH HYDROXYL RADICALS IN AQUEOUS SOLUTION. Bonifacic, M.; Schaefer, K.; Moeckel, H.; Asmus, K. D. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). J. Phys. Chem.; 79: No. 15, 1496-1502(17 Jul 1975).

Interaction of hydroxyl radicals with the sulfur bridge of simple aliphatic disulfides leads to an electron transfer ($RSSR^{\cdot +} + OH^-$) or OH· attachment with about equal probability. $RSSR^{\cdot +}$ radical ions show optical absorption with lambda/sub max/ approximately equal to 420 nm and extinction coefficients of epsilon approximately equal to $2 \times 10^3 M^{-1} cm^{-1}$. Chemically they act as oxidants in their reaction with $Fe(CN)_6^{4-}$, Fe^{2+}/sub aq/, RSOH, etc. The rate constants for electron transfer processes to $RSSR^+$, e.g., from Fe^{2+} /sub aq/, and for the neutralization process $RSSR_+ + OH^-$, seem to depend on the effective electron density at the sulfur bridge. In the absence of reducing agents the radical cations decay by a diffusion-controlled bimolecular process. The chemical fate of the OH· adduct radical depends on the pH of the solution and the structure of the aliphatic groups of the disulfide. In acid solution protons assist S–S bond breaking and rearrangement to thiols and RSO· radicals. The same products are formed in very basic solutions probably via SN2 substitution of RS^- by OH^-. In neutral solutions the formation of RS· radicals and sulfenic acid, RSOH, prevails. Noticeable yields of C–S bond rupture products have only been observed for the tert-butyl compound. This is indicated by the formation of isobutene and trisulfides. (auth)

16870 ELECTRON SCAVENGING AND TRAPPING gamma-IRRADIATED ORGANIC GLASSES. Ito, T.; Fueki, K.; Kuri, Z. (Nagoya Univ., Japan). J. Phys. Chem.; 79: No.15, 1513-1516 (17 Jul 1975).

A study was made of electron scavenging and trapping in gamma-irradiated organic glasses at 77°K. Experimental data are presented on the concentration dependences of the yields of biphenyl anions and trapped electrons produced in five glassy matrices containing biphenyl. A kinetic model is developed for analysis of the experimental data, which includes three competitive processes: geminate ion–electron recombination, electron trapping in the matrix, and electron scavenging by a scavenger. Values of kinetic parameters derived from such analysis are reported. The present model can reasonably account for the observed concentration dependences of the yields of biphenyl anions and trapped electrons. However, there remains some discrepancy between the calculated and observed yields of trapped electrons at the higher biphenyl concentrations. (auth)

16871 gamma RADIOLYSIS OF ISOBUTYRATE SALTS. Marshall, R. S.; Tolbert, B. M.; Gottschall, W. C. Jr. (Univ. of Colorado, Boulder). J. Phys. Chem.; 79: No. 15, 1517-1519 (17 Jul 1975).

Isobutyric-1-^{14}C acid was prepared from $Ba^{14}CO_3$ via a Grignard reaction. Eight isobutyrate-1-^{14}C salts were prepared by treating hydroxides or carbonates with isobutyric-1-^{14}C acid. The salts were irradiated in vacuo with gamma radiation from a ^{137}Cs source. $^{14}CO_2$ from the salts was quantitatively measured by an ionization chamber method and $G(^{14}CO_2)$ values were calculated. Initial $G(^{14}CO_2)$ values for sodium, potassium, calcium, strontium, barium, nickel(II), copper(II), and zinc isobutyrate-1-^{14}C are 0.34, 1.2, 1.5, 1.1, 1.9, 0.48, 0.48, and 1.3, respectively. (auth)

16872 EFFECTS OF GAMMA RADIATION ON AQUEOUS SOLUTIONS OF PHENOL. Coffman, L. M.; Woodbridge, D. D. (Florida Inst. of Technology, Melbourne). Bull. Environ. Contam. Toxicol.; 11: No. 5, 461-466(May 1974).

The use of gamma radiation to treat industrial and municipal wastes containing phenols was tested. Irradiation of the aqueous solutions of phenols showed that the phenol structure could be destroyed by gamma radiation. At phenol concentrations of 10 mg/liter, almost complete destruction occurred at a dose rate of one million rads. For concentrations of less than 5.0 mg/liter, a dose rate of 10,000 rads reduces the phenol concentration to less than 0.6 mg/liter, which is an 88 percent reduction. Results of this work indicate that the destruction of phenols by gamma radiation is feasible. (LK)

16873 HEATS OF REACTION OF TRAPPED INTERMEDIATES IN γ-IRRADIATED ORGANIC GLASSES AND RELAXATION PROCESSES IN UNIRRADIATED GLASSES MEASURED BY LOW TEMPERATURE DIFFERENTIAL THERMAL ANALYSIS. Hager, S.L.; Willard, J.E. (Department of Chemistry, University of Wisconsin, Madison, Wisconsin 53706). J. Chem. Phys. 63: No. 2, 942-952 (15 July 1975).

Differential thermal analysis (DTA) has been used to determine the following: (1) the heat of photobleaching of trapped electrons in γ-irradiated 3-methylpentane (3MP) glass as a function of γ dose; (2) the heats of combination of radicals and of ions in γ-irradiated 3MP and methyltetrahydrofuran (MTHF) glasses; (3) the glass transition temperatures and the rates of enthalpy loss during 77 K annealing of 3MP-h_{14}, 3MP-d_{14}, 3-ethylpentane, and MTHF; (4) the effect of cooling rate and annealing time on crystallization of *n*-hexane in 3MP cooled to 77 K. The ΔH of neutralization of photobleached electrons in γ-irradiated 3MP at 72 K is ~ -150 kcal mole^{-1} at low dose, implying an upper limit of 80 kcal mole^{-1} for the solvation energy of the combining charges, and decreases to ~ 80 kcal mole^{-1} for a dose of 1.2×10^{20} eV g^{-1} implying an increasing ratio of reaction with radicals to reaction with cations as the dose is increased. When γ-irradiated MTHF is warmed from 77 K, a large fraction of the trapped electrons appear to react with radicals to form carbanions, which then react with cations, the total ΔH being ~ 80 kcal mole^{-1}. The ΔH of ion pair solvation is estimated to be -120 to -150 kcal mole^{-1}. The decrease in the enthalpy of the matrix due to relaxation during annealing in 3MP at 77 K parallels the decrease in the decay rate of trapped electrons for similar samples. Seemingly anomolous effects of sample size and shape on trapped electron decay rates in 3MP glass as a function of time of annealing at 77 K can now be rationalized in terms of the restrictions on viscous flow in different types of sample tubes. (auth)

16874 INTERMOLECULAR ELECTRON TRANSFER BY QUANTUM MECHANICAL TUNNELING. Miller, J. R. (Argonne National Lab., IL). Science; 189: No. 4198, 221-222(18 Jul 1975).

The transfer of electrons from one molecule to another by quantum mechanical tunneling has recently been implicated in biological electron transport. This report describes observations of electron transfer between aromatic molecules in a rigid matrix, in which electrons apparently tunnel through tens of angstroms of inert solvent. The kinetics tend to confirm the tunneling process, which is likely to be an important means of electron transfer when diffusion is blocked by steric factors or immobilization of the reactants. (auth)

16875 NEW EASY METHOD FOR OBTAINING APPROXIMATE REDOX POTENTIALS OF RADICALS, PRODUCED BY ^{60}Co-gamma-RADIOLYSIS, USING HETEROPOLY ELECTROLYTES OF MOLYBDENUM AND TUNGSTEN AS ELECTRON ACCEPTORS. The Redox Potential of Some Alcohol and Organic Acid Radicals. Papaconstantinou, E. (Democritus Nuclear Research Center, Athens). Anal. Chem.; 47: No. 9, 1592-1595(Aug 1975).

The reducing ability of short lived radicals can be studied by reacting them with electron acceptors whose redox potential is known. Heteropoly electrolytes of molybdenum and tungsten are used for this purpose. The reduction of these species proceeds in distinct reduction steps producing the corresponding heteropoly blues until the potential of the next reduction step is more negative than the potential of the radical. The apparent redox potentials of some alcohols and formic acid radicals have been determined. (auth)

16876 ELECTRON SPIN RESONANCE STUDIES OF PHENYL AND PYRIDYL RADICALS IN AQUEOUS SOLUTION. Zemel, H.; Fessenden, R. W. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 79: No. 14, 1419-1427(3 Jul 1975).

ESR spectra of a number of phenyl and 2-pyridyl radicals have been detected in aqueous solution. Two methods of radical production were used, namely, reaction of $SO_4^{\cdot -}$ produced by photolysis of $S_2O_8^{2-}$ with aromatic carboxylate ions and reaction of e^-/sub aq/ produced by radiolysis with aromatic bromides. Most radicals had only carboxyl groups as further substituents. The g factors of phenyl and 2-pyridyl radicals are low (near or below the free electron value) reflecting their sigma nature. The presence of carboxyl groups in a phenyl radical affects the g factor in an additive fashion with increments of 13, -2, and -3 units in the fifth decimal place for ortho, meta, and para substituents, respectively. The observation of phenyl and 2-pyridyl radicals demonstrates in a direct way that these radicals are formed in the two above-mentioned reactions. Phenyl and 2-pyridyl radicals with no ortho carboxyl group were found to be very reactive toward addition to another aromatic molecule and were best detected using low concentrations (5×10^{-4} M) of aromatic bromide. Spectra of the unsubstituted phenyl and 2-pyridyl radicals were obtained in this way from the corresponding bromides. At higher solute concentrations such as used for the decarboxylation reactions these radicals react further to form adducts of the cyclohexadienyl type. Radicals with an ortho carboxyl group are much less reactive toward addition and could be studied at higher concentrations of the starting compound. Reaction of $SO_4^{\cdot -}$ with acids in which three (or more) adjacent

carboxyl groups are present leads preferentially to loss of a central or interior carboxyl group. To provide data for comparison with earlier indirect studies, a number of adducts of phenyl and pyridyl radicals to CH_2 double bonds NO_2^- and trimesate were studied and their hyperfine constants determined. In the latter cases it was found that the ortho and meta protons in the phenyl radical which has added (i.e., the side group in the final cyclohexadienyl radical) can produce splittings of approximately 0.05 and approximately 0.3 G, respectively. The radicals detected in experiments in which SO_4^-· reacts with terephthalate and trimesate are thus shown to be adducts of phenyl type radicals to the starting molecule and not SO_4^-· adducts as previously suggested. (LK)

16877 SOLUTE ENVIRONMENTAL EFFECTS IN THE ONE-ELECTRON REDUCTION OF LYSOZYME IN AQUEOUS SOLUTION. Hoffman, M. Z. (Boston Univ.); Hayon, E. J. Phys. Chem.; 79: No. 14, 1362-1369(3 Jul 1975).

The reaction of lysozyme with hydrated electrons generated pulse radiolytically produces an initial transient absorption with lambda/sub max/ 420 nm which can be attributed to the formation of the one-electron reduced lysozyme radical with the unpaired electron highly localized on one of the disulfide linkages. The value of k(e /sub aq/ + lys) ranges from 1.4×10^{11} M^{-1} sec^{-1} at pH 5.7 to 1.5×10^{10} M^{-1} sec^{-1} at pH 12 and is dependent upon the ionic strength of the solution. This initial transient absorption, which is also produced by the reaction of CO_2^- radicals with lysozyme, decays in less than 10^{-3} sec to reveal a secondary absorption centered around 420 nm. The pH-dependent decay kinetics of this secondary absorption are mainly first order with k a function of the concentration of added solutes including phosphate buffer, tert-butyl alcohol, glycine, NaCl, and formate. The reduced lysozyme species is evidently very sensitive to its solution environment which suggests that ionic associations and solvent structure perturbations affect the conformation of the radical and its subsequent decay kinetics. (auth)

16878 METAL PRECIPITATION FROM PULSE IRRADIATED SOLUTIONS OF CADMIUM(II) AND SIMILAR CATIONS. Barkatt, A.; Rabani, J. (Hebrew Univ., Jerusalem). J. Phys. Chem.; 79: No. 14, 1359-1362(3 Jul 1975).

The precipitate obtained upon irradiating Ar-saturated Cd^{2+} aqueous solutions containing alcohols or formate is shown to consist of pure cadmium metal. The yield of Cd^0 indicates that the principal reaction undergone by Cd^+ ions is disproportionation to Cd^0 and Cd^{2+}. The chemical properties and optical spectrum of Cd^0 in suspension were studied. The latter was found to consist of a large-grain dispersion by Cd^0, with absorption peaks in the uv which are attributed to interaction between Cd^0 and dissolved Cd^{2+}. This system makes it possible to analyze the kinetic processes associated with the nucleation and growth of metallic precipitates through the use of pulse radiolytic techniques. The amount of precipitate obtained from various divalent ions is correlated with their effectiveness in reducing $G(H_2)$. (auth)

16879 RADIATION-INDUCED GRAFTING ONTO WOOL. A Kinetic Analysis. Schnautz, N. G.; Du Plessis, T. A. (Atomic Energy Board, Pretoria). J. Appl. Polym. Sci.; 19: No. 8, 2099-2106(Aug 1975).

The radiation-induced graft copolymerization of styrene onto wool in aqueous methanol was studied over a temperature range of 0°C to 45°C and a radiation dose-rate range of 0.05 to 2.0 Mrad/hr. The rate of grafting was found to obey the classical polymerization equation. Chain transfer to wool was found to play an important role in the grafting process, and the molecular weight of the resulting graft copolymer was found to be independent of the irradiation dose. The activation energy of the graft process changed from a value of 4.7 kcal/mole below 19°C to a value of 18.7 kcal/mole above this temperature. This phenomenon is ascribed to the formation of hydrogen-bonded systems between the protic solvent molecules and the protein chain in the wool. (auth)

16880 NEW RADIATION DEFECT FORMED IN GAMMA-IRRADIATED GLYCINE. Komar, I. N.; Nikolov, O. T.; Pal, Sh. (Kharkov State Univ.). Teor. Eksp. Khim.; 10: No. 6, 840-844 (1974). (In Russian).

An EPR method was used to determine the tensor parameter of hyperfine alpha-proton interaction for a radiation defect NH_2CHCOO^-, formed simultaneously with the earlier known $^+NH_3CHCOO^-$ in molecular crystals of gamma-irradiated glycine. The tensor of alpha-proton hyperfine interaction of the two defects was compared. Based on this and comparison of the data obtained with calculated spin densities for NH_2CHCOO^- molecules, conclusions are presented concerning the structure of this defect and its orientation in the lattice. (tr-auth)

16881 STRUCTURE OF FREE RADICALS FORMED IN GAMMA-IRRADIATED GAMMA-GLYCINE. Komar, I. N.; Nikolov, O. T.; Maier, I. (Kharkov State Univ.). Teor. Eksp. Khim.; 10: No. 6, 839-840(1974). (In Russian).

Study of EPR spectra of gamma-irradiated gamma-glycine showed that in this material, as in alpha-glycine, free radicals of the type $^+NH_3CHCOO^-$ and CH_2COO^- are formed in almost the same yield and with almost the same stability. (tr-auth)

16882 RADIOLYSIS OF AQUEOUS SOLUTIONS OF SUGAR PHOSPHATES. Kochetkov, N.; Kudrjashov, L. I.; Chlenov, M.; Grineva, L. P. (Inst. of Organic Chemistry, Moscow). Carbohydr. Res.; 35: 235-241(Jul 1974).

The mechanism of the radiation-induced dephosphorylation reaction was investigated by studying the γ-radiolysis of 10 mM solutions of D-glucopyranosyl phosphate, D-glucose 6-phosphate (Glc-6-P), and D-ribose 5-phosphate (Rib-5-P). Dephosphorylation occurred with OH-radical participation, since $G(H_3PO_4)$ values for nitrous oxide-saturated solutions were 4.1, 1.7, and 2.3, and for nitrogen-saturated solutions 2.6, 1.1, and 1.6, respectively. The formation of phosphate-free compounds accompanied the release of inorganic phosphate. The main, neutral products of the radiolysis of Glc-6-P were 6-deoxyhexos-5-ulose (G = 0.2) and D-gluco-hexodialdose (G = 0.3). Irradiation of Rib-5-P gave ribo-pentodialdose and 5-deoxypentos-4-ulose as the main, neutral products. A scheme for the dephosphorylation process is proposed. (auth)

16883 CLEAVAGE OF THE CARBON-COBALT BOND IN VITAMIN B_{12} AND COENZYME B_{12} BY REDUCTION WITH ELECTRONS IN γ-IRRADIATED FROZEN SOLUTIONS. Seki, H.; Shida, T.; Imamura, M. (Inst. of Physical and Chemical Research, Wako, Japan). Biochim. Biophys. Acta; 372: No. 1, 100-108 (Nov 1974).

The one-electron reduction of vitamin B_{12} and its coenzyme has been studied by γ-irradiation of the frozen methanolic solutions of these compounds. A new optical absorption spectrum was obtained by γ-irradiation of aqueous methanol solution of vitamin B_{12} at 77°K. ESR spectra were also recorded. Upon slight warming the optical and ESR spectra changed to those ascribed to B_{12r}. The present study revealed that the one-electron reduction of vitamin B_{12} and its coenzyme B_{12} gives rise to the heterolytic cleavage of the Co-C bonds by the selective attack of electrons, and the former produces B_{12r} and the latter, B_{12s}. (INIS)

16884 CONCENTRATION DEPENDENCE OF PARAMAGNETIC RELAXATION OF RADICALS IN GAMMA-IRRADIATED POLYMERS AND THE EFFECT OF SPACE DISTRIBUTION AND MOLECULAR MOTION. Mamunya, E. P.; Vonsyatskii, V. A.; Lebedev, Ya. S. (Inst. of Chemistry of High-Molecular Compounds, Kiev). Teor. Eksp. Khim.; 10: No. 6, 794-799(1974). (In Russian).

A continuous saturation method was used to determine the relaxation parameters ΔH_{pp} and T_1 of radicals formed in gamma radiolysis of polyurethane (PU) at doses of 3 to 86 Mrad at 77°K. The dependence of these parameters on the radical concentration during their accumulation and annealing was studied. The "hysteresis" dependence was found, and analysis of it led to qualitative conclusions concerning the changes in space distribution and molecular mobility in the polymer matrixes. In the radiolysis, the PU radicals accumulated in a random manner and their distribution was homogeneous. The rate of spin-lattice relaxation, $1/T_1$, was independent of the concentration, which suggests that the relaxation goes through "exchange pockets," the role of which may be played by close radical pairs. In the initial annealing stages there is a sharp increase in ΔH_{pp}, which indicates an increased frequency of conformation oscillations corresponding to an STV modulation as a result of relaxation of local tensions. The observed simultaneous drop in $1/T_1$ is due to overlapping of the relaxation channel through close pairs as a result of their disappearance upon annealing. (tr-auth)

Radiochemistry and Nuclear Chemistry

Hot-Atom Chemistry

16885 (COO-1617-41) GAS AND LIQUID PHASE HOT ATOM CHEMISTRY: MONOVALENT ATOMS (ORGANIC). Rack, E. P. (Nebraska Univ., Lincoln (USA). Dept. of Chemistry). 1975. 35p. (CONF-750550-1). Dep. NTIS $4.75.

From 8th international hot atom chemistry symposium; Spa-Balmoral, Belgium (25 May 1975).

Gas and liquid phase hot atom chemistry of hydrogen and halogens is reviewed. The nuclear recoil technique for production of the hot atoms is considered. (LK)

16886 SEPARATION OF NUCLEAR REACTION PRODUCTS IN THE GAS PHASE. I. Separation of Tc in a Flow of Oxygen. Baechmann, K.; Matschoss, V. (Technische Univ., Darmstadt, Ger.). J. Inorg. Nucl. Chem.; 37: No. 1, 15-19(Jan 1975).

The separation of nuclear reaction products in the gas phase was investigated using a ^{252}Cf source. A detailed study of the behavior of Tc-nuclides that form a volatile oxide with oxygen was carried out. The yields of technetium are given as a function of the oxygen concentration, the temperature of the cooling trap and the temperature of the transfer tube. The total yield of Tc is ≥50 ± 15 per cent. (auth)

16887 SEPARATION OF THE RECOIL PRODUCTS OF INORGANIC PHOSPHORUS OXYACIDS BY CROSS ELECTROPHORESIS. Kitaoka, Y. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Chem. Lett. (Tokyo); No. 10, 1247-1250 (Oct 1974).

An attempt was made to separate the recoil products of phosphorus oxyacids (salts of hypophosphite, phosphite, orthophosphate and pyrophosphate) by a cross electrophoresis using zinc ions. This electrophoresis was found to have a general applicability to the isolation of a trace amount of a proper compound from a given matrix that forms insoluble complexes. (auth)

16888 CHEMISTRY OF NUCLEAR RECOIL ^{18}F ATOMS. VII. Detection of Caging Reactions in Liquid Phase CF_3CH_3 and CHF_2CH_3. Manning, R. G.; Root, J. W. (Univ. of California, Davis). J. Phys. Chem.; 79: No. 14, 1478-1480(3 Jul 1975).

Recent findings that collisional stabilization of primary energetic ^{18}F substitution reaction products in CF_3CH_3 and CHF_2CH_3 occurs to a significant extent (greater than or equal to 20 percent) over the same reactant density range in which caging reactions take place are reported. (LK)

16889 GAS TO LIQUID TO SOLID TRANSITION IN HALOGEN HOT ATOM CHEMISTRY. II. Systematics of Bromine Reactions Activated by Radiative Neutron Capture and Isomeric Transition with Halomethanes. Berg, M. E.; Grauer, W. M.; Helton, R. W.; Rack, E. P. (Univ. of Nebraska, Lincoln). J. Phys. Chem.; 79: No. 14, 1327-1337(3 Jul 1975).

Bromine reactions activated by $^{79}Br(n,gamma)^{80}Br$, $^{81}Br(n,gamma)$/sup 82m/Br + ^{82}Br, and /sup 82m/Br(I,T.)^{82}Br nuclear transformations were studied in halomethanes as functions of mole fraction of Br_2, phase, density, and intermolecular distance. Gas phase systematics coupled with the density and mole fraction of Br_2 studies demonstrate the existence of systematic trends in the condensed phases as evidenced by the Richardson-Wolfgang effect. A definitive difference due to activation that is independent of system and suggests the importance of caging at higher densities is shown by the variation of total and individual organic product yields with density. The study of total organic product yield vs. intermolecular distance provides both a means of separating cage and molecular reactions and suggests the importance of molecular properties in the caging event. (auth)

Properties of Radioactive Materials

Refer also to abstracts 16751, 17612, 17628, 17810, 18707, 19106, and 19107.

16890 (AAEC/E-333) PILOT PLANT DEVELOPMENT OF PROCESSES FOR THE PRODUCTION OF AMMONIUM DIURANATE. Janov, J.; Alfredson, P. G.; Vilkaitis, V. K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jan 1975. 23p. Dep. NTIS (US Sales Only) $4.25.

Nuclear grade ammonium diuranate (ADU) and UO_2 powders were produced on a pilot plant scale by the continuous single-stage precipitation of ADU with ammonium hydroxide, dewatering with a rotary drum vacuum filter or a solid bowl centrifuge, and batch-tray drying and calcination-reduction to UO_2 powder. Precipitation at 50°C and pH values in the range 7.2 to 8.0 produced ADU materials that could be converted to UO_2 powder by calcination and reduction at temperatures of 600 to 730°C, and fabricated into sintered pellets with densities of 10.37 to 10.77 g cm^{-3}. The lower the pH of precipitation the lower was the reduction temperature required to achieve a specified pellet density. Precipitation with ammonium hydroxide at 80°C and with ammonia gas at 50°C offered no advantages over precipitation with ammonium hydroxide at 50°C. The UO_2 powders and sintered pellets produced from ADU powders precipitated by the three methods were similar. Dewatering of ADU slurries was carried out more efficiently using a solid bowl centrifuge rather than a rotary drum vacuum filter. Clearer discharge liquids were produced at a higher rate of throughput in the solid bowl centrifuge. (auth)

16891 (AAEC/E-347) PRODUCTION OF SINTERABLE URANIUM DIOXIDE FROM AMMONIUM DIURANATE. Part III. Continuous Production in a Pulsed Fluidised Bed Reactor. Fane, A. G.; LePage, A. H. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Feb 1975. 27p. Dep. NTIS (US Sales Only) $4.50.

The development of a 0.13 m diameter pulsed fluidised bed reactor for the continuous production of sinterable uranium dioxide from ammonium diuranate is described. Calcination-reduction at 670 to 680°C produced powders with surface areas of 4 to 6 $m^2 g^{-1}$ giving pellet densities in excess of 10.6 g cm^{-3}. Sinterability was relatively insensitive to changes in operating conditions, provided the availability of hydrogen was adequate, for gas flow rates in the range 0.95 to 1.4 l s^{-1}, pulse frequencies of 0.5 and 0.75 Hz and mean residence times of the solids from 0.6 to 1.4 hours. Sinterability was improved either by use of higher input concentrations, or by use of a secondary flow of hydrogen (about 5 per cent of input) fed into the powder collection system and flowing countercurrent to the UO_2 product. The maximum throughput of 17 kg UO_2 h^{-1} (0.6 hours mean residence time) required only 120 per cent of the stoichiometric requirement at an input concentration of 50 vol.% with secondary hydrogen flow. Results are given for studies of the kinetics of reduction of calcined ammonium diuranate in hydrogen and the residence time distribution of solids in a pulsed fluidised bed. Estimates based on these data suggested that the overall conversion of ammonium diuranate to uranium dioxide in the continuously operated pulsed fluidised bed reactor was in excess of 99 per cent. Continuous stabilisation of the UO_2 product was demonstrated at 12 kg h^{-1} of UO_2, in a 0.15 m diameter glass stabiliser, using 10 vol. % air in nitrogen and a temperature of about 50°C. (auth)

16892 (AEC-tr-7533/2) NUKLEONIKA. Translation of Nukleonika; 19: No. 2, 79-156(1974). 73p. Dep. NTIS $5.45.

16893 (BNWL-1917) DECONTAMINATION AND DECOMMISSIONING OF NUCLEAR FACILITIES: A LITERATURE SEARCH. Sande, W. E.; Freeman, H. D.; Hanson, M. S.; McKeever, R. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-1830. 155p. Dep. NTIS $5.45.

This bibliography includes 429 unclassified references to the decontamination and decommissioning of nuclear facilities. The references are arranged in chronological order and cover the period from 1944 through 1974. Subject and author indexes are provided. (auth)

16894 (CEA-CONF-3035) CHEMICAL EXCHANGE BETWEEN UF_6 AND UF_6^- ION IN ANHYDROUS HYDROFLUORIC ACID. Chatelet, J.; Luce, M.; Plurien, P.; Rigny, P. (CEA, 75 - Paris (France)). 1975. 6p. (CONF-750324-6). Dep. NTIS (US Sales Only) $4.00.

From international conference on uranium isotope separation; London, UK (5 Mar 1975).

From the previously reported data and from experimental results, seemingly, the basic characteristics of the chemical exchange between UF_6 and UF_6^- ion, are already stated particularly in ORD-694. A few other physico-chemical aspects of the problem seem to cause difficulties. Attempts to oxidize $NOUF_6$ dissolved in HF with a good yield (close to 100%) in a reasonable time failed. Although several powerful fluorinating agents (F_2, ClF_3, ClF_5, BrF_3, BrF_5) were tried, the actual yields never exceeded 95% in times as long as three days. (MCG)

16895 COMPARISON OF PHOTOLUMINESCENCE AND ADSORBOLUMINESCENCE SPECTRA PRODUCED BY PURE AND DOPED THORIUM OXIDE. Bressat, R.; Breysse, M.; Claudel, B.; Sautereau, H.; Williams, R. J. J. (Institut National des Sciences Appliquees, Villeurbanne, France). J. Lumin.; 10: No. 3, 171-176(Apr 1975).

Photoluminescence and adsorboluminescence for pure and doped thorium oxide are compared and shown to be distinct. It is deduced from this comparison that the luminescence transitions are different. A tentative scheme for the adsorboluminescence mechanism is proposed. (NL)

16896 POLAROGRAPHIC REDUCTION OF URANYL-BENZENEHEXACARBOXYLATE COMPLEXES IN AQUEOUS AND DIMETHYL SULFOXIDE SOLUTION. Lai, T. T.; Wen, C. S. (Cheng Kung Univ., Taiwan). Anal. Chim. Acta; 76: No. 2, 309-318(Jun 1975).

The reduction of the uranyl-mellitate complex at the dropping mercury electrode has been studied in aqueous and dimethyl sulfoxide solution. In aqueous solution, besides the reduction waves of the uranyl-mellitate complex, corresponding to the reduction of U(VI) to U(V), and of U(V) to U(III), an adsorption wave and a catalytic hydrogen wave were obtained; the species formed below pH 4.0 was $UO_2(H_3A)^-$ and above pH 4.0 was $UO_2(OH)(H_3A)^{2-}$. In

dimethyl sulfoxide solution, two well-defined waves were observed; the first wave is due to reduction of a uranyl-mellitate-DMSO complex, and the second to reduction of mellitic acid. The species involved are $UO_2(DMSO)_8^{2+}$ below pH 2.2 and $UO_2(H_3A)(DMSO)_5^{-1}$ above pH 2.2. The activation energies of the reduction process were determined. (NL)

16897 THERMODYNAMICS OF VAPORIZATION OF NEPTUNIUM AND PLUTONIUM. Ackermann, R. J.; Rauh, E. G. (Argonne National Lab., IL). J. Chem. Thermodyn.; 7: No. 3, 211-218(Mar 1975).

The vapor pressure of liquid neptunium was determined over the temperature range 1540 to 2140°K by a combination of mass-effusion and mass-spectrometric measurements. The measured pressures are given by $\log_{10}\{p^0(Np)/atm\} = -\{22370 \pm 95)K/T + (5.196 \pm 0.056)$ and the resulting enthalpy and entropy of vaporization and the standard deviations therein are $\Delta H_0^0(Np, 1800°K) = (102.4 \pm 0.4)$ $kcal_{th}$ mol^{-1} and $\Delta S_0^0(Np, 1800°K = (23.8 \pm 0.3)$ cal_{th} K^{-1} mol^{-1}. The enthalpy of sublimation at 298°K is estimated as $\Delta H_s^0(Np, 298 K) = (110 \pm 2)$ $kcal_{th}$ mol^{-1}. The vapor pressure of plutonium was redetermined over the temperature range 1210 to 1620°K. The results yield $\log\{p^0(Pu)/atm\} = -(17120 \pm 114) K/T + (4.592 \pm 0.082)$, $\Delta H_0^0(Pu, 1400°K) = (78.3 \pm 0.5)$ $kcal_{th}$ mol^{-1}, and $\Delta S_0^0(Pu, 1400°K) = (21.0 \pm 0.4)$ cal_{th} K^{-1} mol^{-1}. The measured pressures are 20 to 30% less than those of two previously reported absolute measurements. Based on a recent assessment of the thermal functions for solid and liquid plutonium, the results of the present study show the best second-third law agreement, i.e., $\Delta H_s^0(II, Pu, 298.15 K) = (82.8 \pm 0.5)$ $kcal_{th}$ mol^{-1} and $\Delta H_s^0(III, Pu, 298.15 K) = (83.3 \pm 0.4)$ $kcal_{th}$ mol^{-1}. (auth)

16898 DEVELOPMENT AND USE OF A SYSTEM FOR ROUTINE PRODUCTION OF MONODISPERSE PARTICLES OF $^{238}PuO_2$ AND EVALUATION OF GAMMA EMITTING LABELS. Raabe, O. G.; Boyd, H. A.; Kanapilly, G. M.; Wilkinson, C. J.; Newton, G. J. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Health Phys.; 28: No. 6, 655-667(Jun 1975).

From 19th annual meeting of the Health Physics Society; Houston, Texas (7 Jul 1974).

A system has been designed, constructed, tested and used for producing large quantities of monodisperse ($\sigma_g < 1.2$) submicrometer particles of $^{238}PuO_2$ with density about 7.8 g/cm^3 which are being used in inhalation experiments with dogs and rodents. The system consists of a series of five stainless steel glove boxes housing the aerosol generation system for producing polydisperse $^{238}PuO_2$, an aerosol chamber and four Lovelace Aerosol Particle Separator units to separate the polydisperse PuO_2 into monodisperse fractions and collect them. The collected monodisperse particles of PuO_2 are subsequently suspended in water containing a suitable particle stabilizing agent and nebulized to provide monodisperse respirable aerosols of $^{238}PuO_2$ particles. The use of ^{51}Cr and ^{169}Yb as γ-emitting labels for $^{238}PuO_2$ has been studied. Much ^{51}Cr left the $^{238}PuO_2$ particles under the 1150°C heat treatment so that neither uniform nor adequate labeling was achieved. The nuclide ^{169}Yb, however, was both a uniform and relatively stable label for $^{238}PuO_2$ aerosols although ytterbium dissolution was somewhat higher than for the plutonium. (auth)

16899 RADIOPHARMACEUTICAL PRODUCTS SECTION. Fallais, C. J. Rev. IRE; 1: No. 2, 3-6(Jun 1974). (In French and Dutch).

The radiopharmaceutical section is divided into three groups: research and development, preparation of radiopharmaceutical preparations, and pharmaceutic control. The activities of each of these is described. (JSR)

16900 NORMAL COORDINATE ANALYSIS OF DICAESIUM URANYL TETRACHLORIDE ($Cs_2UO_2Cl_4$). Ohwada, K. (Japan Atomic Energy Research Inst., Tokyo). Spectrochim. Acta, 31A: No. 7, 973-977(Jul 1975).

The ir spectrum of dicaesium uranyl tetrachloride ($Cs_2UO_2Cl_4$) was measured in the 4000-30 cm^{-1} region. A normal coordinate analysis of the $(UO_2Cl_4)^{2-}$ anion apart from the Cs^+ ions was made using Wilson's FG matrix method (Wilson, E. B., Decius, J. C. and Cross, P. C., Molecular Vibrations, McGraw-Hill, New York, 1955), and the observed frequencies were quantitatively assigned on the basis of the potential energy distribution and L-matrix. In addition to the analysis, an interaction of the outer Cs^+ ions with the inner $(UO_2Cl_4)^{2-}$ anion was investigated. (auth)

16901 NOVEL PREPARATION OF TRITIUM- AND TRIMETHYLSILYL-LABELLED AROMATICS. Taylor, R. (Univ. of Sussex, Eng.). Tetrahedron Lett.; No. 7, 435-436(Feb 1975).

Previous attempts to label aromatics via hydrolysis of organometallic intermediates with tritiated water have occasionally been frustrated, when the correct hydrocarbon has been obtained, but containing no tritium. Reasons for this are discussed, in terms of reaction kinetics. It is concluded that it is necessary for the hydrolysing or coupling reagent to be in situ before adding the organometallic compound. The required tritiated compounds were obtained by wetting sodium-dried ether with tritiated water, dissolving the halogenaromatic in this, cooling to about –70° and then adding n-butyllithium. Reaction is virtually instantaneous and high incorporation of tritium results. Other examples of the method are given. (UK)

16902 PREPARATION OF IODINE-123 LABELLED SODIUM ORTHO-IODO HIPPURATE AND ITS CLEARANCE BY THE RAT KIDNEYS. Thakur, M. L.; Chauser, B. M.; Hudson, R. F. (Hammersmith Hospital, Eng.). Int. J. Appl. Radiat. Isot.; 26: No. 5, 319-320(May 1975).

A method described by Elias et al. (Int. J. Appl. Radiat. Isot.; 24: 26 (1973)) for labeling m-iodo-hippuric acid with ^{131}I by the synthesis of the stable compound followed by the isotopic exchange between the radioactive iodide and the compound in a molten state, has been simplified by the present authors for preparing ^{123}I-labeled o-iodo-hippuric acid (hippuran). The material was found to be stable and renograms obtained in the rat with this material and with the previously described material were compared and found similar. (UK)

16903 CRYSTAL STRUCTURE OF UAsS, UAsSe, AND UAsTe. Pietraszko, D.; Lukaszewicz, K. (Technical Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 23: No. 4, 337-340(1975).

The crystal structures of UAsS, UAsSe and UAsTe were determined by x-ray diffraction. UAsS and UAsSe are isomorphic with PbFCl and UAsTe is isomorphic with UGeTe. For all structures accurate atomic positional parameters refined by the least-squares method are presented. Coordination polyhedra and interatomic distances are discussed and the crystal structure of UAsSe is compared with the results obtained by neutron diffraction. (auth)

16904 IONIC POTENTIALS OF CATIONS AND TYPES OF PHASE EQUILIBRIA IN $MeCl_n$–UCl_4 SYSTEMS. Gawel, W. (Inst. of Chemistry and Chemical Technology, Wroclaw). Rocz. Chem.; 49: No. 4, 699-704(1975).

The effect of the ionic potentials ratio of cations of components on the type of phase equilibria was analyzed using as an example binary uranium tetrachloride systems. (auth)

16905 SYNTHESIS OF DIPEPTIDES FROM TRITIUM-LABELLED AMINO ACIDS. Kolodziejczyk, A.; Arendt, A. (Polytechnical Inst., Danzig). Rocz. Chem.; 49: No. 4, 777-779(1975).

Tritium-labelled amino acids of a market quality have been used in the form of dilute water solutions. L-Alanyl-(2,3-T)-L-alanine and glycyl-(2-T)-sarcosine have been prepared with a high radiochemical yield. (auth)

16906 COMPLEX URANIUM(IV)-α-ALANINE IN AQUEOUS SOLUTION. Folcher, G.; Neveu, C.; Rigny, P. (CEN de Saclay, Gif-sur-Yvette, France). J. Inorg. Nucl. Chem.; 37: No. 6, 1537-1538(Jun 1975). (In French).

On account of their biological interest, many studies have been made of the complexes formed by amino acids and cations. The literature contains several references to the reactions of uranyl compounds and of lanthanides. In the present work, uranium (IV) was chosen for its paramagnetic properties, and α-alanine as an example of a simple amino acid. Experimental details are presented. Measurements were made of pH, polarography, electric conductivity, and nuclear magnetic resonance. (UK)

16907 ION-EXCHANGE INVESTIGATION OF THE ARSENAZO III-URANYL SYSTEM. Confirmation of the Physical Existance of a Weak M_2L-Type New Complex Compound. Perez-Bustamante, J. A. (Consejo Superior de Investigaciones Cientificas, Madrid). Talanta; 22: No. 4-5, 447-452(Apr 1975).

Ion-exchange experiments proved the physical existence in the arsenazo III-uranyl system of an M_2L complex species in addition to the well-known ML complex. The emerald-green M_2L complex exhibits a very low stability, which permits the preparation of pure stoichiometric bluish ML complex solutions by percolation of the former through a cation-exchanger in the sodium form. Both complexes exhibit a similar visible spectrum with maxima located at 605 and 655 nm, the maximum absorptivity of M_2L being slightly greater ($\epsilon_{655} \sim 5.8 \times 10^4$ $1.mole^{-1}$ cm^{-1}) than that of $ML(\epsilon_{655} = 5.0 \pm 0.3 \times 10^4)$. The complexes have a net negative charge, which depends strongly on the particular washing conditions used for the complexes sorbed on chloride-form anion-exchange resins. (auth)

16908 ^{32}P DISTRIBUTION INTO 2,3-BISPHOSPHOGLYCERIC ACID FROM HUMAN ERYTHROCYTES FOLLOWING MOLYBDATE-CATALYZED HYDROLYSIS. Snyder, L. M.; Neri, L. L.;

Rice, R. E.; Fortier, N. (St. Vincent Hospital, Worcester, MA). Biochim. Biophys. Acta; 381: No. 1, 157-164(13 Jan 1975).

Normal human washed erythrocytes were incubated in autologous plasma with ^{32}P for varying periods of time. 2,3-Bisphosphoglyceric acid the major organic phosphate ester of red cells, was first isolated and purified by anion-exchange chromatography; subsequently, the C-2 P_i was selectively hydrolyzed by a molybdate-catalyzed reaction. The C-2 bound P_i of 2,3-P_2-glyceric acid was found to have a significantly higher specific activity than C-3 P_i. Intramolecular equilibration was not reached until the 180-min incubation. No evidence of overhydrolysis or internal randomization by the molybdate reaction was noted which was confirmed following hydrolysis of double-label 2,3-P_2-glyceric acid (^{32}P C-2, ^{33}P C-3). (NL)

16909 PREPARATION OF ^{203}Pb COMPOUNDS FOR STUDIES ON PATHWAY AND EFFECTS OF LEAD POLLUTION. Girardi, F.; Goetz, L.; Sabbioni, E.; Marafante, E.; Merlini, M.; Acerbi, E.; Birattari, C.; Castiglioni, M.; Resmini, F. (Commission of the European Communities, Ispra, Italy). Int. J. Appl. Radiat. Isot.; 26: No. 5, 267-277(May 1975).

Successful production of ^{203}Pb radioisotope with the proton beam of the Milan AVF cyclotron has made possible to start a wide range research program on pathway and effects of lead pollution. Irradiation and radiochemical separation techniques are described in some detail together with the synthesis of ^{203}Pb tetraethyl lead. Applications to environmental problems carried out so far include chemical biological and biochemical studies. Preliminary results and the relevant experimental details are reported concerning lead uptake by different biological systems, and the distribution of lead in the air. (auth)

16910 ELECTRODIALYTIC DECONTAMINATION OF APPLE JUICE. Frindik, O. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp 229-257 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

Inactive or radioactive cesium and strontium salts were added to clear apple juice and removed by electrodialysis. Conditions are described which permit removal of about 98% of the added quantity of cations, without affecting the quality of the apple juice. (auth)

16911 ROLE OF ASCORBIC ACID REACTION WITH THE FERRIC ION IN LABELLING HUMAN SERUM ALBUMIN WITH ^{99m}Tc. Yokoyama, A.; Kominami, G.; Harada, S.; Tanaka, H. (Kyoto Univ.). Int. J. Appl. Radiat. Isot.; 26: No. 5, 291-299 (May 1975).

The chemistry of a purple complex formed in the course of the preparation of ^{99m}Tc-human serum albumin as a radiopharmaceutical for diagnosis was studied. This compound, which is characterized as a unhydrolyzed ferric ascorbate complex, is assumed to be produced from ferrous ion and ascorbic acid through the formation of ferrous ascorbate (1: 1) complex with the participation of molecular oxygen. The present results suggest that, independently of the reaction with molecular oxygen, the ferrous ascorbate complex reacts with $^{99m}TcO_4^-$ to form a reduced ^{99m}Tc species, which is then incorporated into human serum albumin. At the same time, the purple ferric complex was found to form a stable complex with ^{99m}Tc. Thus the presence of ferric complex is unfavorable for the labelling of human serum albumin with ^{99m}Tc. The high labelling efficiency was achieved by the labelling procedure under nitrogen atmosphere in the presence of deferoxamine, which coordinates selectively with ferric ion with an extremely high stability constant. (auth)

16912 COMPLEXING OF TETRAVALENT ACTINIDES WITH BROMIDE IONS. Raghavan, R.; Ramakrishna, V. V.; Patil, S. K. (Bhabha Atomic Research Centre, Bombay). J. Inorg. Nucl. Chem.; 37: No. 6, 1540-1541(Jun 1975).

In continuation of earlier work [Patil et al., Radiochim. Acta; 18: 190 (1972); J. Inorg. Nucl. Chem.; 35:3333 (1973); Radiochim. Acta; 19: 27 (1973)] on the determination of stability constants of complexes of tetravalent actinides with different inorganic ions using solvent extraction technique, the bromide complexes of Th(IV), Np(IV) and Pu(IV) were studied and are reported here. (auth)

16913 PRODUCTION OF RADIOACTIVE AEROSOL PARTICLES. Takahashi, K. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy). Hoken Butsuri; 9: No. 2, 117-121(Jun 1974). (In Japanese).

Radioactive aerosol particle is thought to be very useful for experimental works on aerosol technology. However, for the practical use of radioactive aerosols, the production method must be carefully selected from the viewpoint of safety in the operation as well as the fitness for use. Various methods utilized are reviewed. (auth)

16914 OXIDATION OF URANIUM DIOXIDE. Ohashi, H.; Noda, E.; Morozumi, T. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). J. Nucl. Sci. Technol. (Tokyo); 11: No. 10, 445-451(Oct 1974).

The oxidation of UO_2 was studied by thermogravimetry and x-ray diffraction. It was clarified that the thermal history covering the first stage of the oxidation from UO_2 to U_3O_7 significantly influenced the rate of the oxidation of the second stage from U_3O_7 to U_3O_8. The entire oxidation reaction proceeded in what to all appearances was a single stage when the specimen temperature was raised rapidly, whereas at slower rates of heating up, two distinct stages of oxidation were observed, separated by an intermediate induction period. These findings suggest the existence of a close connection between the rate of formation of the U_3O_7 phase and the rate of the subsequent oxidation of this phase: A slow formation of U_3O_7 would tend to prolong the induction period preceding the second stage of the oxidation. A similar effect was observed also with annealing of the intermediate U_3O_7 at 200°C: The increase of annealing time prolonged the induction stage. The rate of the second stage oxidation was fairly well expressed by Johnson and Mehl's equation, $\log(1/(1-y)) = (1/2.303)k^n t^n$. The time exponent n in this equation varied in the range of 1.0 to 2.5, and the rate constant k of 1.15×10^{-4} to 2.04×10^{-1} min^{-1}, depending on the experimental conditions. (auth)

16915 POTENTIOMETRIC AND SPECTROPHOTOMETRIC STUDIES OF FLUORIDE COMPLEXES OF URANIUM(IV). Kakihana, H.; Ishiguro, S. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor). Bull. Chem. Soc. Jap.; 47: No. 7, 1665-1668(Jul 1974).

The stability constants and the molar extinction coefficients of uranium(IV) fluoride complexes were determined in aqueous solutions containing 1 M $(Na^+ + H^+)Cl^-$ as a constant ionic medium at 25°C. The emf data obtained by the use of a fluoride-ion-selective electrode were explained in terms of the formation of a series of mononuclear complexes, UF^{3+}, UF_2^{2+}, UF_3^+, and UF_4, with stability constants $\beta_1 = (2.2 \pm 0.13) \times 10^7$, $\beta_2 = (1.33 \pm 0.05) \times 10^{13}$, $\beta_3 = (2.9 \pm 0.5) \times 10^{17}$, and $\beta_4 = (6 \pm 1) \times 10^{21}$, respectively. Using these values for β's the spectra observed in the 350-700 nm region were analyzed by means of a computer in order to estimate the molar extinction coefficients of each uranium(IV) fluoride complex species. (auth)

16916 THE BIOSYNTHESIS OF ALOENIN IN ALOE ARBORESCENS MILL. VAR. NATALENSIS BERGER. Suga, T.; Hirata, T.; Koyama, F.; Murakami, E. (Hiroshima Univ. (Japan). Faculty of Science). Chem. Lett. (Tokyo); No. 8, 873-876(Aug 1974).

The ^{14}C-labeling pattern in aloenin (I) biosynthesized from [2-^{14}C]malonate, [1-^{14}C]acetate, [1-^{14}C]- and [3-^{14}C]phenylalanine, and [methyl-^{14}C]methionine in Aloe arborescens Mill. var. natalensis Berger demonstrated that the carbon skeleton of aloenin is generated by the acetate-malonate pathway and that the methyl of the methoxyl group is originated from methionine. (auth)

16917 KINETICS OF PARALLEL DEHYDROGENATION AND DEHYDRATION OF 2-PROPANOL ON OXIDE CATALYSTS. Jambor, J.; Beranek, L. (Inst. of Chemical Process Fundamentals, Prague). Collect. Czech. Chem. Commun.; 40: No. 5, 1374-1383(May 1975).

Kinetics of parallel dehydrogenation and dehydration of 2-propanol at 350°C on a series of metal oxides whose selectivity changed from prevailing dehydration to prevailing dehydrogenation (ThO_2, TiO_2, La_2O_3, Cr_2O_3, ZrO_2, and MgO) were studied. While the ratio of rate constants of the equations of Langmuir-Hinshelwood type for dehydrogenation and dehydration changes along the series of catalysts by nearly three orders of magnitude, small difference in the ratio of adsorption coefficients of 2-propanol for these two reactions indicated a nonspecific character of its primary interaction with catalyst surface. The effects of products and other substances were also studied and expressed by means of corresponding adsorption coefficients on La_2O_3. Water and acetone exhibited much stronger rate-retarding effect on the reactions which led to their formation than on the other reaction. This indicates that reaction centers for dehydration and dehydrogenation are different, the corresponding product being however weakly adsorbed also on surface sites which do not participate in its formation. Propene and hydrogen were not essentially adsorbed. Selectivity of the decomposition depended on partial pressures of 2-propanol and water and on the conversion of the alcohol. (auth)

16918 PREPARATION OF SOME LABELED GLYCOSPHINGOLIPIDS BY CATALYTIC ADDITION OF TRITIUM. di Cesare, J. L.; Rapport, M. M. (New York State Psychiatric Inst.). Chem. Phys. Lipids.; 13: No. 4, 447-452(Dec 1974).

Three experiments are described in which seven tritium-labeled glycosphingolipids were prepared by catalytic addition of tritium gas to unsaturated centers. These compounds include glucosyl ceramide, galactosyl ceramide, lactosyl ceramide (cytolipin H), N-acetylgalactosaminyl ($\beta 1 \rightarrow 3$) galactosyl ($\alpha 1 \rightarrow 3$) galactosyl ($\beta 1 \rightarrow 4$) glucosyl ceramide (cytolipin R), and three species of gangliosides: G_{M1} (G_4), G_{M3} (G_5), and G_{D1a} (G_7). (NL)

16919 NEW PROCEDURE FOR LABELLING LUTEINIZING HORMONE WITH TRITIUM. de La Llosa, P. (CNRS, Gif-sur-Yvette, France); de La Llosa-Hermier, M. P.; Marche, P.; Morgat, J. L. FEBS (Fed. Eur. Biochem. Soc.) Lett.; 45: No. 1, 162-165(Sep 1974).

A procedure is reported for the tritiation of LH* by reductive methylation of its lysine residues with tritiated $NaBH_4$. The tritiated LH derivative fully retains its biological potency when measured by the ovarian ascorbic acid depletion bioassay of Parlow. (LK)

Radioactive Waste Treatment

Refer also to abstracts 16736, 17149, 17165, 17181, 17911, 18844, 18865, and 19170.

16920 (ARH-SA-222) CONTINUOUS PROCESS FOR IMMOBILIZING RADIONUCLIDES, INCLUDING CESIUM AND RUTHENIUM FISSION PRODUCTS. Isaacson, R. E.; Brownell, L. E. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Apr 1975. AT-(45-1)-2130. 18p. (CONF-750542-5). Dep. NTIS $4.00.

From 77th annual meeting of the American Ceramic Society; Washington, District of Columbia, USA (3 May 1975).

Radionuclide wastes are continuously converted to glass in an electro-heated furnace. The process incorporates an exothermic reaction using silicon or aluminum to form aluminosilicates of low-melt viscosity and high-product durability. The reducing conditions in the melt prevent loss of ruthenium, and cesium is captured in an aluminosilicate lattice. (auth)

16921 (BNWL-1698) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, NOVEMBER 1972. Division of Production and Materials Management and Hanford Plant Assistance Programs. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1972. 16p. Dep. NTIS $4.00.

Assistance to Atlantic Richfield Hanford Company is summarized. Progress in the following programs is reviewed: Plutonium scrap processing; environmental and regulatory technology; waste management; and process technology. Technical assistance to the Hanford Plant is also reviewed. (JGB)

16922 (CONF-740807-P1, pp 177-202) SELECTIVE ADSORPTION-DESORPTION METHOD FOR THE ENRICHMENT OF KRYPTON. Yuasa, Y. (Nippon Atomic Industry Group Co. Ltd., Kawasaki, Japan); Ohta, M.; Watanabe, A.; Tani, A.; Takashima, N. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Selective adsorption-desorption method has been developed as an effective means of enriching krypton and xenon gases. A series of laboratory-scale tests were performed to provide some basic data of the method when applied to off-gas streams of nuclear power plants. For the first step of the enrichment process of the experiments, krypton was adsorbed on solid adsorbents from dilute mixtures with air at temperatures ranging from -50^0C to -170^0C. After the complete breakthrough was obtained, the adsorption bed was evacuated at low temperature by a vacuum pump. By combining these two steps krypton was highly enriched on the adsorbents, and the enrichment factor for krypton was calculated as the product of individual enrichment factors of each step. Two types of adsorbents, coconut charcoal and molecular sieves 5A, were used. Experimental results showed that the present method gave the greater enrichment factor than the conventional method which used selective adsorption step only. (auth)

16923 (CONF-740807-P1, pp 246-262) AKUT: A PROCESS FOR THE SEPARATION OF AEROSOLS, KRYPTON, AND TRITIUM FROM BURNER OFF-GAS IN HTR-FUEL REPROCESSING. Laser, M.; Barnert-Wiemer, H.; Beaujean, H.; Merz, E.; Vygen, H. (Kernforschungsanlage, Juelich, Ger.). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The AKUT process consists of the following process steps: (1) aerosol retention by an electrostatic separator followed by HEPA filters, (2) oxidation of CO with O_2 or reaction of excess O_2 with CO, respectively, (3) compression, (4) scrubbing and/or liquefaction, (5) separation of krypton by distillation, and (6) separation of tritiated water and iodine by adsorption or chemical reaction. Liquefied off-gas with low permanent gas content resulting from graphite burning with oxygen may be distilled at ambient temperature. Off-gas with higher permanent gas content from burning with oxygen enriched air must be processed at lower temperature. The ambient temperature flow sheet is preferable from an economic as well as safety point of view. (auth)

16924 (CONF-740807-P1, pp 263-275) ABSORPTION PROCESS FOR REMOVING KRYPTON FROM THE OFF-GAS OF AN LMFBR FUEL REPROCESSING PLANT. Stephenson, M. J.; Dunthorn, D. I.; Reed, W. D.; Pashley, J. H. (Oak Ridge Gaseous Diffusion Plant, TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The Oak Ridge Gaseous Diffusion Plant selective absorption process for the collection and recovery of krypton and xenon is being further developed to demonstrate, on a pilot scale, a fluorocarbon-based process for removing krypton from the off-gas of an LMFBR fuel reprocessing plant. The new ORGDP selective absorption pilot plant consists of a primary absorption-stripping operation and all peripheral equipment required for feed gas preparation, process solvent recovery, process solvent purification, and krypton product purification. The new plant is designed to achieve krypton decontamination factors in excess of 10^3 with product concentration factors greater than 10^4 while processing a feed gas containing typical quantities of common reprocessing plant off-gas impurities, including oxygen, carbon dioxide, nitrogen oxides, water, xenon, iodine, and methyl iodide. Installation and shakedown of the facility were completed and some short-term tests were conducted early this year. The first operating campaign using a simulated reprocessing plant off-gas feed is now underway. The current program objective is to demonstrate continuous process operability and performance for extended periods of time while processing the simulated "dirty" feed. This year's activity will be devoted to routine off-gas processing with little or no deliberate system perturbations. Future work will involve the study of the system behavior under feed perturbations and various plant disturbances. (auth)

16925 (CONF-740807-P1, pp 277-292) RETENTION OF KRYPTON ON POLYMETHYL METHACRYLATE. Ciric, M. M.; Cvjeticanin, N. M.; Radak, B. B. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Retention of krypton on polymethyl methacrylate was studied as a function of kryptonation pressure (P), temperature (T) and time (t). It was found that the dependence of the retained quantity on P, T, and t is in accordance with the diffusion theory. The optimum results (i.e., the maximum retained quantity and the best stability of the kryptonate) were obtained at elevated kryptonation temperatures (200^0C). The diffusion coefficients of krypton in polymethyl methacrylate, determined from the dekryptonation process, vary from 1×10^{-10} cm^2/s to 0.2×10^{-10} cm^2/s for samples kryptonated at 20^0C and 200^0C respectively. The results have been discussed from the viewpoint of radiation and thermal stability of kryptonated polymethyl methacrylate. Inadequate radiation stability could be the main obstacle for practical purposes. (auth)

16926 (CONF-740807-P2, pp 683-706) ELEMENTAL IODINE AND METHYL IODIDE ADSORPTION ON ACTIVATED CHARCOAL AT LOW CONCENTRATIONS. Bellamy, R. R. (Ohio State Univ., Columbus). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The capability of activated charcoal to adsorb elemental iodine and methyl iodide at low concentrations has been experimentally evaluated to observe the effect of the variation of certain operating parameters within specified limits. The operating parameters include inlet concentration, superficial velocity, relative humidity, type of charcoal and impregnant, charcoal mesh size, duration of test and bed depth. The data obtained in an intensive study of these parameters have been correlated assuming a two-step adsorption mechanism for radioiodine on activated charcoal. The correlation is presented to aid the nuclear industry in design ing charcoal adsorber systems for radioiodine retention. (auth)

16927 (CONF-740807-P2, pp 707-735) BEHAVIOR OF HIGHLY RADIOACTIVE IODINE ON CHARCOAL. Lorenz, R. A.; Martin, W. J.; Nagao, H. (Oak Ridge National Lab., TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference; (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The behavior of highly radioactive iodine adsorbed on charcoal has been investigated in a series of seven experiments which used amounts of radioactive ^{130}I ranging from 0.2 to 1100 Ci on well-insulated adsorber beds containing 28 cm^3 of impregnated charcoal. Desorption of several forms of iodine into flowing dry air were observed at moderate temperatures (80 to 125°C). When the air velocity was reduced from 28.5 fpm (25°C) to 3.8 fmp (25°C), the charcoal temperature rose quickly during experiments which contained 500 Ci or more because of reduced air cooling. Ignition of the charcoal occurred during four of the experiments. Heat released from the slow oxidation of charcoal below its ignition temperature was measured and was found to contribute significantly to the attainment of ignition. CHART, a computer program for calculating charcoal adsorber bed temperatures, accurately duplicated the experimentally observed temperature behavior, including ignition, after the program had been modified to include the heat released by oxidation of the charcoal. A penetrating form of iodine, probably methyl iodide, was released continuously at low rates which were compatible with previously proposed radiation-induced mechanisms. The distribution and movement of elemental iodine in the test bed were followed by means of a movable collimated gamma scanner. Linear adsorption isotherm coefficients were calculated, but some correction appeared to be appropriate at high iodine concentrations. Retention of iodine was better at high temperature when the total atomic concentration of potassium was greater than that of iodine. (auth)

16928 (CONF-740807-P2, pp 736-742) IODINE FISSION PRODUCT MASS TRANSFER IN ADSORBENT MEDIA. Kovach, J. L.; Hunt, J. R. (Nuclear Consulting Services Inc., Columbus, OH). Mar 1975.

From 13th air cleaning conference; San Francisco California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The iodine and methyl iodide removal efficiency of new and exposed adsorbent media was evaluated using tracer techniques. Particular attention was paid to keep the inlet iodine concentration near the atmospheric iodine concentration of 10^{-3} mu g/m^3. The zone depth of activity was measured at 5.08–81.28 cm/sec (10–160 fpm) in a segmented adsorber system. The obtained results are useful for both the design of air cleaning systems and iodine fission product sampling cartridges. (auth)

16929 (CONF-740807-P2, pp 743-757) EFFECT OF ALKALI METAL CONTENT OF CARBON ON RETENTION OF IODINE AT HIGH TEMPERATURES. Evans, A. G. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Activated carbon for filters in reactor confinement systems is intentionally impregnated with iodine salts to enhance the removal of radioiodine from air streams containing organic iodides. When a variety of commercial impregnated carbons were evaluated for iodine retention at elevated temperatures (4 hours at 180°C), wide variations in iodine penetration were observed. The alkali metal and iodine content of carbon samples was determined by neutron activation analysis, and a strong correlation was shown between the atom ratio of iodine to alkali metals in the carbons and the high-temperature retention performance. Carbons containing excess alkali (especially potassium) have iodine penetration values 10 to 100 times lower than carbons containing excess iodine. Both low I/K ratios and high pH values were shown essential to high efficiency iodine retention; therefore, conversion of elemental iodine to ionic iodine is the basic reaction mechanism. The natural high K^+ content and high pH coconut carbons make coconut the preferred natural base material for nuclear air cleaning applications. Studies show, however, that treatment of low potassium carbons with a mixture of KOH and I_2 may produce a product equal to or better than I_2-impregnated coconut carbons at a lower cost. (auth)

16930 (CONF-740807-P2, pp 758-764) SOLID ADSORBENTS FOR COLLECTION AND STORAGE OF IODINE-129 FROM REPROCESSING PLANTS. Pence, D. T.; Staples, B. A. (Allied Chemical Corp., Idaho Falls, ID). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Because of the long half-life and relatively large quantities produced during fission of nuclear fuels, ^{129}I will have to be recovered and stored indefinitely to prevent undue radiation exposure to the local population around nuclear fuel reprocessing facilities. Although release limits have not been specified for reprocessing plants, an interim design objective of at least a 10^6 reduction is suggested. Methods proposed for collection of ^{129}I from reprocessing plant effluents include wet scrubbing and the use of solid adsorbents. The relative merits for the use of solid adsorbents for collection and long-term storage of iodine are discussed. (auth)

16931 (CONF-740807-P2, pp 765-800) TESTING AND EVALUATION OF ABSORBERS FOR GASEOUS PENETRATIVE FORMS OF RADIOIODINE. Kabat, M. J. (Central Health Physics Services, Pickering, Ont.). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A significant fraction of airborne radioiodine, encountered at times in operational areas of Ontario Hydro nuclear power generating stations, was found to be penetrative inorganic and organic species. Theoretical evaluation of iodine chemistry is presented in this paper based on analysis of operational iodine concentrations in station systems, areas and effluents under actual operating conditions. The theoretical evaluation and the operational experiments show that hypoiodous acid and organic iodides are the basic forms of airborne iodine which occur in the field and in station effluents. A method was developed for laboratory generation of HOI and its identity confirmed by use of specific absorbers. Six of the commercially available (and recently developed) absorbers were tested for HOI removal efficiency in the laboratory under conditions similar to those found in the field. Experimental equipment, methods used for the absorber testing and experimental conditions are described. It is evident from results of these measurements that charcoals have generally better initial absorption efficiency for hypoiodous acid than silver impregnated inorganic absorbers. Both technical and economical aspects of the operational use of the tested absorbers are discussed. (auth)

16932 (CONF-740807-P2, pp 801-814) PERFORMANCE OF NON-COCONUT BASE ADSORBERS IN REMOVAL OF IODINE AND ORGANIC IODIDES. Rivers, R. D.; Pasha, M.; Fowler, E. E.; Goldsmith, J. M. (American Air Filter Co., Inc., Louisville, KY). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Systems for the removal of radioactive iodine and organic iodides have used impregnated coconut shell activated carbons almost exclusively. Coconut shell carbons have some disadvantages: their geographical origin determines their trace chemical content: pore structures and impregnant effectiveness are highly

dependent on activation and impregnation techniques. The authors report laboratory performance of a group of iodine-organic iodide adsorbers using bases other than coconut shell carbon. These have been evaluated in conformity with USAEC Regulatory Guide 1.52 and and RDT M16 1T. Performance with regard to $^{131}I_2$ and $CH_3{}^{131}I$ penetration and high-temperature elution have equaled or exceeded both the requirements of Guide 1.52 and results on typical coconut-shell carbons. Some performance outside Guide 1.52 ranges is included. Experimental problems in simulated LOCA testing are discussed. (auth)

16933 (CONF-740807-P2, pp 815-831) ADSORPTION OF METHYL IODIDE ON IMPREGNATED ALUMINA. Gal, I. J.; Muk, A.; Todorovic, M.; Rajnvajn, J.; Cvjeticanin, D.; Vujisic, L. (Boris Kidric Inst., Belgrade). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The kinetics of adsorption of gaseous methyl iodide on a commercial alumina impregnated with various metal nitrate salts has been investigated in a static gas-solid adsorption apparatus, in the range 50-150°C. Strong chemisorption of iodine has been noted with silver nitrate impregnation, and to a lesser degree with cadmium and lead nitrate. At 100°C lead and cadmium nitrate are nearly as efficient in binding iodine as silver nitrate. In the absence of humidity, silver oxide is a superior impregnation than silver nitrate. Mixed-salts impregnation as Ag + Cd are also promising. The decrease of the rate of methyl iodide adsorption with increasing vapor pressure of water has been recorded for some adsorbents. Samples impregnated with silver nitrate (7.4 wt. percent Ag) have been also tested in a dynamic adsorption facility, under various conditions of humidity, flow-rate and temperature of the air stream, at high methyl iodide concentrations. The retention of methyl iodide decreases strongly with increasing humidity and face velocity of the air stream, but increases with increasing temperature. An improved technique of impregnation might be helpful to overcome at least partly the adverse effect of humidity. (auth)

16934 (CONF-740807-P2, pp 832-844) IODINE SCRUBBING FROM OFF-GAS WITH CONCENTRATED NITRIC ACID. Yarbro, O. O.; Mailen, J. C.; Groenier, W. S. (Oak Ridge National Lab., TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A new process, named Iodox, for effectively scrubbing all id iodine forms from off-gas streams with concentrated (approximately 20 M) nitric acid has been developed. This process removes all significant iodine species, both elemental and organic, from a gas stream by oxidizing them to the nonvolatile iodate form. Advantages of the Iodox system for removing iodine from nuclear fuel reprocessing plant off-gas include: 1. It is capable of removing kilogram quantities of iodine while delivering a concentrated iodine waste stream for permanent disposal. 2. It is relatively insensitive to the contaminants normally found in a reprocessing plant off-gas stream and effectively removes all significant iodine forms. 3. Nitric acid is used in the process; thus no significant chemicals are introduced to the plant process or waste handling systems. Laboratory-scale studies indicate that iodine retention factors in excess of 10^4 for methyl iodide can be obtained in a multistaged bubble-cap column. A small engineering-scale demonstration of the complete process, including the iodine scrubbing column, iodine waste concentration and solid I_2O_5 handling, and acid reconstitution and recycle, is in progress. The flowsheet being used for the engineering-scale system demonstration is typical of an application of the Iodox process to a fuel reprocessing plant. (auth)

16935 (CONF-740807-P2, pp 929-947) POSSIBILITIES OF TRITIUM REMOVAL FROM WASTE WATERS OF PRESSURIZED WATER REACTORS AND FUEL REPROCESSING PLANTS. Ribnikar, S. V. (Belgrade Univ.); Pupezin, J. D. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Starting from parameters known for heavy water production processes, a parallel was made with separation of tritium from water. The quantity in common is the total cascade flow. The most efficient processes appear to be hydrogen sulfide, water exchange, hydrogen- and water distillation. Prospects of application of new processes are discussed briefly. Problems concerning detritiation of pressurized water reactors and large fuel reprocessing plants are analyzed. Detritiation of the former should not present problems. With the latter, economical detritiation can be achieved only after some plant flow patterns are changed. (auth)

16936 (CONF-740807-P2, pp 1093-1103) RADIOIODINE SORPTION ON ACTIVE CARBONS FROM LIQUID PHASE. Vukovic, Z.; Jankovic, O.; Knezevic, L.; Svabic, A. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The results of investigation of the efficiency of various kinds of active carbons to the sorption of iodine species from solution with relatively low impurity content under static and dynamic conditions are given. The effects of pH, temperature, impurity concentration, flow rate and particle size were studied. The physical and chemical parameters of the pressurized water reactor's primary and secondary coolant system were simulated during the study. Under dynamic conditions the effects of pH, temperature, particle size, flow rate is explicit, whereas under static conditions most of these parameters have no significant effect. (auth)

16937 (CONF-740807-P2, pp 1113-1115) GOVERNMENT-INDUSTRY CONFERENCE ON CONTROL OF TRITIUM EFFLUENTS. Trevorrow, L. E. (Argonne National Lab., IL). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The primary objective of this conference was to discuss techniques that might eventually be developed to the point of commercial application if collection and retention of tritium from the light-water reactor fuel cycle becomes mandatory. Attention was focused on the ultimate disposition of low-level aqueous wastes (LLAW), the expected carrier of the major fraction of tritium in the light-water reactor fuel cycle. The discussions included a number of alternative disposal procedures that might be adopted in the event that future regulations prohibit the vaporization of LLAW into the atmosphere. The alternatives were grouped into two major categories; those that included an isotope-separation process, resulting in a concentrate to be stored and a depleted stream to be either dispersed or recycled as make-up water to the fuel-reprocessing plant, and those which do not contain an isotope-separation step. (auth)

16938 (CONF-750807-1) ANAEROBIC COLUMNAR DENITRIFICATION OF HIGH NITRATE WASTEWATER. Francis, C. W.; Malone, C. D. (Oak Ridge National Lab., Tenn. (USA)). 1975. 43p. Dep. NTIS $5.25.

From conference on nitrogen as a water pollutant; Copenhagen, Denmark (18 Aug 1975).

Anaerobic columns were used to test the effectiveness of biological denitrification of nitrate solutions ranging in concentration from 1 to 10 kg NO_3/m^3. Several sources of nitrate ($Ca(CNO_3)_2$, $NaNO_3$, NH_4NO_3, and actual nitrate wastes from a UO_2 fuel fabrication plant) were evaluated as well as two packing media. The packing media were anthracite coal particles, whose effective diameter size ranged between 2 and 3 mm, and polypropylene Raschig rings 1.6 x 1.6 diameter. The anthracite coal proved to be the better packing media as excessive hydraulic short circuiting occurred in a 120 x 15 cm diameter glass column packed with the polypropylene rings after 40 days operation. With anthracite coal, floatation of the bed occurred at flow rates greater than 0.80 cm^3/s. Tapered columns packed with anthracite coal eliminated the floatation problem, even at flow rates as high as 5 cm^3/s. Under optimum operating conditions the anthracite coal behaved as a fluidized bed. Maximum denitrification rates were 1.0–1.4 g $NO_3/m^3/s$ based on initial bed volume. Denitrification kinetics indicated that rates of denitrification became substrate inhibited at nitrate concentrations greater than 6.5 kg NO_3/m^3. Anaerobic columns packed with anthracite coal appear to be an effective method of nitrate disposal for nitrate rich wastewater generated at UO_2 fuel fabrication plants and fuel reprocessing facilities. (auth)

16939 (DPST-74-95-37(Del.)) ECONOMIC COMPARISONS OF ACID AND ALKALINE WASTE SYSTEMS AT SRP. Crandall,

J. L.; Porter, J. A. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 31 Jul 1974. 26p. Dep. NTIS $4.50.

Declassified 18 Jun 1975.

Order-of-magnitude costs for a variety of options for disposal of SRP radioactive processing wastes in retrievable surface storage are given in FY 1975 dollars. The assumption is made that three-reactor operation continues at SRP through the year 2000. Two things are apparent. First, the waste disposal costs are very high, in the range of one to three billion dollars even before escalation to the expected disposal period in FY 1985-2000. Second, the alkaline waste cases are always less expensive then the corresponding acid waste cases even when so-called ideal waste streams are postulated for the acid cases. (LK)

16940 (ORNL-TM-4923) MONITORING AND ANALYSIS OF PROCESS STREAMS IN A KRYPTON-85 OFF-GAS DECONTAMINATION SYSTEM. Levins, D. M.; Glass, R. W.; Chiles, M. M.; Inman, D. J. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 48p. Dep. NTIS $5.45.

The methods used to monitor, sample, and analyze process streams in the Experimental Engineering Section Off-Gas Decontamination Facility are described. This facility is designed to study the removal of noble gases, particularly ^{85}Kr, from reactor fuel reprocessing off-gas streams by high pressure scrubbing with liquid carbon dioxide or Freon. Krypton-85 concentrations in the most important gas streams are monitored continuously with beta-sensitive radiation detectors using a CaF_2(Eu) scintillation disc. These detectors were designed specifically for use with corrosive fluids at high pressures. Representative samples of gas and liquid are withdrawn from 14 process streams via a semiautomatic sampling system. These samples are then analyzed for ^{85}Kr using a beta detector, and for inactive constituents by mass spectrometry. (auth)

16941 DEVELOPMENT WORK ON THE TREATMENT SYSTEMS FOR VOLUME REDUCTION OF RADIOACTIVE SOLID WASTES FROM BOILING WATER REACTOR POWER STATION. Shimozato, A.; Horiuchi, S. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works); Yusa, H.; Sugimoto, Y. Hitachi Hyoron; 56: No. 9, 895-900(Sep 1974). (In Japanese).

A research was conducted for developing a treatment system whose main function is volume reduction of low level radioactive solid wastes from boiling water reactor power plants. In the research a pilot plant composed of a pot calcination system for concentrated liquid waste, an ion exchange resin-filter sludge, and an incineration system for miscellaneous solid wastes was manufactured. In the performance test it was confirmed that the pot calcination system and the incineration system of the plant had a volume reduction rate of about 1/8 and of about 1/10 respectively, which offered a bright prospect for its actual application. (auth)

16942 THE MANAGEMENT OF RADIOACTIVE WASTES IN NUCLEAR POWER GENERATION. Kimura, T. (Electric Power Development Co. Ltd., Tokyo (Japan)). Dengen Kaihatsu K. K., Chosa Shiryo; No. 52, 119-146(Mar 1974). (In Japanese).

To maintain or better human life, nuclear power generation must be pursued with the adequate management of its radioactive wastes. The management of radioactive wastes occurring normally in nuclear power generation is explained on the basis of reports or other literature. The following matters are described: radioactive wastes; the management of radiowastes (i.e., treatment and disposal); nuclear power plants and fuel reprocessing plants as the sources; environmental pollution and its consequences; future problems in the management, including the period of storage, high-level liquid waste, regulations on ocean disposal, global pollution, radioactivity elimination, dismantling of nuclear facilities, cosmic disposal and utilization of FPS; and the deliberations made on the management. (JA)

Radioisotope Production

Refer also to abstracts 17452 and 17929.

16943 (BNWL-1950(Pt. 4), pp 97-100) MEDICAL GRADE PLUTONIUM-238 FROM AMERICIUM-241. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

The objective of this program is to compare and evaluate the economics and the technical practicability of producing medical grade ^{238}Pu by irradiating ^{241}Am recovered from spent power reactor fuel. The ^{241}Am target irradiation could be performed in power reactors. During 1974 the ALTHAEA computer code was calibrated to match experimental data for americium and curium compositions; irradiation calculations were carried out with the ALTHAEA code to define compositions of spent nuclear fuel and americium target elements; work progressed on development of a computer program for the ^{241}Am irradiation cycle analysis and cost optimization calculations; and, preliminary estimates of ^{241}Am recovery costs from spent power reactor fuel were developed. (auth)

16944 EXCITATION FUNCTIONS AND YIELDS FOR ^{123}I PRODUCTION USING THE $^{127}I(p, 5n)^{123}Xe$ REACTION. Wilkins, S. R.; Shimose, S. T.; Hines, H. H.; Jungerman, J. A.; Hegedus, F.; DeNardo, G. L. (Univ. of California, Davis). Int. J. Appl. Radiat. Isot.; 26: No. 5, 279-283(May 1975).

Excitation functions and yields are described for ^{123}I production via the $^{127}I(p,5n)^{123}Xe \xrightarrow{2.1\ hr} ^{123}I$ reaction. The ^{123}Xe excitation functions were determined experimentally by irradiating thin (2 MeV thick) ^{127}I targets at the Crocker Nuclear Laboratory. The ^{123}Xe excitation function is used to obtain ^{123}Xe yield as a function of target thickness for commonly used target materials and for different incident proton energies. These results indicate that yields of several curies per hour of ^{123}Xe are possible using a 10μA proton beam. Radiochemical impurities were measured and found to be small. (auth)

16945 IMPROVED METHOD FOR THE CYCLOTRON PRODUCTION OF ^{13}N-LABELLED AMMONIA. Vaalburg, W.; Kamphuis, J. A. A.; Beerling-van der Molen, H. D.; Reiffers, S.; Rijskamp, A.; Woldring, M. G. (Rijksuniversiteit, Groningen, Netherlands). Int. J. Appl. Radiat. Isot.; 26: No. 5, 316-318 (May 1975).

The production of ^{13}N-ammonia via the reaction $^{16}O(p,\alpha)^{13}N$ by bombarding water with a 15 μA external proton beam of 19 MeV in the AVC cyclotron at the University of Groningen, is reported. A yield of 0.5 Ci of ^{13}N-ammonia is produced routinely with a beam current of 15 μA. Yields from various production methods referred to in the literature are compared in tabular form. (UK)

16946 FISSION PRODUCT ^{99m}Tc GENERATOR. Arino, H.; Kramer, H. H. (Union Carbide Corp., Tuxedo, NY). Int. J. Appl. Radiat. Isot.; 26: No. 5, 301-303(May 1975).

A ^{99m}Tc generator system was developed with much improved characteristics. The generator system takes advantage of the low, but usable, loading capacity (2 mg-Mo/g alumina at pH of 5 to 6) of the acid form of alumina and the high specific activity (~10^5 Ci/g Mo) of ^{99}Mo produced by the fission of ^{235}U. No pre- or post-loading treatment of the alumina is needed when the pH of the loading ^{99}Mo solution is between 5 and 6. Greater than 95% ^{99m}Tc yields were obtained when using 4 ml of a saline eluant with ^{99}Mo loadings of 1 mCi to 20 Ci; high radiation levels do not reduce the ^{99m}Tc yield. The major advantages of a ^{99m}Tc generator made from fission product ^{99}Mo as compared to one made by $^{98}Mo(n,\gamma)^{99}Mo$ are ease of production, consistently high ^{99m}Tc yields, lower ^{99}Mo breakthrough, higher activity generator and higher ^{99m}Tc concentration. (auth)

16947 POSSIBILITY OF PRODUCTION OF VAPORS OF RADIOACTIVE IODINE-131 TO SIMULATE ATMOSPHERE CONTAMINATED WITH IODINE-131. Brnovic, R.; Radanovic, R.; Rankovic, M. Naucno-Teh. Pregl.; 21: No. 10, 59-61(1971).

A system was constructed for the production of vapors of radioactive iodine-131. The working of the system is based on the liberating of iodine vapors by the oxidation of iodides into iodine. (Bull. sci. Sect. A)

16948 RADIOCHEMICAL SEPARATION OF RADIOACTIVE Sr AND Y FROM NEUTRON BOMBARDED Zr TARGET. Masuyama, S.; Murakami, Y. (Tokyo Metropolitan Univ. (Japan). Faculty of Science). Jap. Anal.; 23: No. 9, 993-999(Sep 1974). (In Japanese).

Two methods for rapid, high-purity radiochemical separation of Y and Sr from Zr in chemical form suitable for counting are announced. (a) Separation of Y from Zr target: The bombarded Zr metal sheet (1.5g) was placed in a plastic centrifuge tube with 20 mg of Y(III) carrier. The Zr was thoroughly dissolved by adding 5 ml of 1 N HCl and 5 ml of 4 N HF dropwise. The solution was cooled in an ice bath for 3 minutes; YF_3 precipitate was separated centrifugally. The supernatant, including ZrF_6^{2-}, was discarded with a pipette. The precipitate was centrifugally washed with 2 ml of 1 N HF solution, then dissolved with a mixture of 3 ml of saturated boric acid solution and 2 ml of concentrated nitric acid. The solution was transferred to a glass centrifuge tube and the whole volume of the solution was made to 10 ml. The solution was brought to pH 8 with ammonia to precipitate Y. The precipitate, centrifugally separated, was dissolved with 5 ml of 0.05 N HCl. Again yttrium was precipitated by 2 ml of saturated oxalic acid solution, and separated by filtration. After being washed with alcohol and ether, the precipitate was mounted for counting. Radiochemical yield of Y was 70 + 5%. (b) Separation of Sr from Zr target: The bombarded Zr target was placed in a plastic centrifuge tube with 10 mg of

Sr(II) as the carrier. Four ml of HF(46.2%) was added dropwise to completely dissolve the Zr. Then 10 ml of ice-cooled fuming nitric acid (d = 1.52) was poured into the tube which was in an ice bath. After 5 minutes, the precipitate was centrifugally separated. The supernatant containing Zr was discarded. The precipitate was washed with an aliquot of cooled nitric acid. After dissolution of the precipitate in 3 ml water, the solution was transferred to a glass centrifuge tube with 10 mg of Y(III) carrier as scavenger. The volume of the solution was adjusted to 5 ml. The solution was brought to pH 8 with ammonia to precipitate yttrium hydroxide which was centrifuged and then washed with 2 ml of water. Strontium carbonate was precipitated with 1 ml of 1 M ammonium carbonate solution. The precipitate was washed with alcohol and ether and mounted for counting. Radiochemical yield of Sr was 60 ± 2%. (auth)

16949 ^{18}F AND ^{13}N PRODUCTION BY A VAN DE GRAAFF ACCELERATOR. Reed, M. F. (Kentucky Univ., Lexington); McEllistrem, M. T.; Pettit, W. A. Phys. Med. Biol.; 20: No. 3, 493-494(May 1975).

The short-lived β^+ emitting radionuclides ^{18}F and ^{13}N, which are of interest for medical uses and in chemical syntheses, have been produced in improved yields. The reactions were $^{20}Ne(d,\alpha)^{18}F$ and $^{12}C(d,n)^{13}N$ respectively, and a deuteron energy of 5.4 MeV was used with a beam current of 5 μA (2 μA in the case of ^{18}F-fluorine production). Target gases were at 1 atm with 10^{-4} inch entrance windows. A bombardment time of 1 hour gave recovered activities of ^{18}F of 29 mCi as ^{18}F-fluoride and 2.7 mCi as ^{18}F-fluorine; 25 min bombardment of methane gave a total recovered activity of ^{13}N of 21 mCi (16 mCi as ^{13}N-ammonia). (UK)

Reactor Fuel Reprocessing

Refer also to abstracts 16924 and 17899.

16950 (CONF-740807-P1, pp 232-245) DEVELOPMENT OF THE KRYPTON ABSORPTION IN LIQUID CARBON DIOXIDE (KALC) PROCESS FOR HTGR OFF-GAS REPROCESSING. Glass, R. W.; Beaujean, H. W. R.; Cochran, H. D. Jr.; Haas, P. A.; Levins, D. M.; Woods, W. M. (Oak Ridge National Lab., TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Reprocessing of High-Temperature Gas-Cooled Reactor (HTGR) fuel involves burning of the graphite-matrix elements to release the fuel for recovery purposes. The resulting off-gas is primarily CO_2 with residual amounts of N_2, O_2, and CO, together with fission products. Trace quantities of krypton-85 must be recovered in a concentrated form from the gas stream, but processes commonly employed for rare gas removal and concentration are not suitable for use with off-gas from graphite burning. The KALC (Krypton Absorption in Liquid CO_2) process employs liquid CO_2 as a volatile solvent for the krypton and is, therefore, uniquely suited to the task. Engineering development of the KALC process is currently under way at the Oak Ridge National Laboratory (ORNL) and the Oak Ridge Gaseous Diffusion Plant (ORGDP). The ORNL system is designed for close study of the individual separation operations involved in the KALC process, while the ORGDP system provides a complete pilot facility for demonstrating combined operations on a somewhat larger scale. Packed column performance and process control procedures have been of prime importance in the initial studies. Computer programs have been prepared to analyze and model operational performance of the KALC studies, and special sampling and on-line monitoring systems have been developed for use in the experimental facilities. (auth)

16951 (ICP-1068) INTERIM EXPERIMENTAL RESULTS: PRIMARY GRAPHITE BURNER TESTING WITHOUT FINES RECYCLE. Palmer, W. B. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Jun 1975. Contract AT(10-1)-1375. 36p. Dep. NTIS $4.00.

A 4-inch diameter, fluidized-bed burner was used to test primary burning of HTGR graphite fuel. The results of fifteen runs which were made to test the effect of fluidizing velocity, feed rate, bed temperature, and bed depth on fines generation and combustion efficiency are reported. (auth)

16952 (MRR-142) CRITICALITY SAFETY BY GADOLINIUM POISONING AND CONCENTRATION LIMITATION FOR FUEL SOLUTIONS IN THE REPROCESSING OF NUCLEAR FUELS. Thomas, W. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Feb 1975. 51p. (In German). Dep. NTIS (US Sales Only) $5.75.

Complex criticality safety control mechanisms are to be established for the reprocessing of fuel elements in large scale reprocessing plants. The use of gadolinium as a homogeneous poison and restrictions of the concentrations of fissile material were investigated for homogeneous uranium and plutonium solutions. Appropriate criticality data are calculated after checking the calculational method against experiment. Special attention is given to treatment of uranium–plutonium mixed solutions with relatively high plutonium content as expected in reprocessing of plutonium LWR-fuel elements. (auth)

16953 (ORNL-TM-4863) ENGINEERING DEVELOPMENT STUDIES FOR MOLTEN-SALT BREEDER REACTOR PROCESSING NO. 19. Hightower, J. R. Jr. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 52p. Dep. NTIS $5.45.

Fabrication and assembly of carbon steel vessels for metal transfer experiment MTE-3B was continued. Examination of the vessels and analyses of the salt and metal phases from the previously operated experiment MTE-3 was completed. Internal surfaces exposed to salts and bismuth appeared in excellent condition. Failure of the oxidation-resistant protective coating on the external surfaces allowed significant oxidation of these surfaces at the 650°C operating temperature, but was not extensive enough to affect the vessel integrity. A different protective coating with superior air-oxidation resistance was applied to the MTE-3B vessels. X-ray fluorescence analyses of the Li-Bi phase from the rare-earth stripper at the LiCl–Li-Bi interface contained significant amounts of iron and thorium. In salt-metal contactor development five runs were made in the 5- by 7-in.-Plexiglas contactor with phase volumes, agitator speed, and initial mercury-phase zinc concentrations held constant at 1.8 liters, 150 rpm, and 0.1 M, respectively. A model was developed for this system under the assumption that the reaction takes place entirely at the water-mercury interface and is instantaneous and irreversible. A 6-in. diam low-carbon steel stirred interface contactor was installed in the Salt-Bismuth Flowthrough Facility. Results from the first six runs using ^{97}Zr and ^{237}U tracers indicate that the salt-phase mass transfer coefficient based on ^{237}U counting data is 37 +- 3 percent of the value predicted by the Lewis correlation for runs 1, 2, 3, and 5, and is 116 +- 10 percent of the Lewis value for runs 4 and 6. The relatively high values for the latter two runs are probably due to dispersal of salt into the bismuth. The mass transfer coefficients based on ^{97}Zr counting data are felt to be less reliable than those based on ^{237}U because of the inability to correct for self absorption of the 743.37 keV beta$^-$ in the solid bismuth samples. Engineering studies of fuel reconstitution were begun. Reaction of gaseous UF_6 with UF_4 dissolved in molten salt and the subsequent reduction with hydrogen of the resultant UF_5 will be a flowthrough operation, and the main vessels will consist of a 36-liter feed tank, a UF_6 absorption vessel, a hydrogen reduction column, and a receiver vessel. (MCG)

16954 CONTRIBUTION OF CHEMISTRY TO THE DEVELOPMENT OF HTR FUEL. Flowers, R. H. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Inst. Nucl. Eng.; 16: No. 2, 35-43(Mar 1975).

A broad review is presented of the chemist's contribution to the nuclear power programme, and more particularly the development of high temperature reactor (HTR) fuels. Emphasis is on the type of problem that requires engineers and chemists to collaborate in the design and development of a nuclear power station. Discussions on the paper are included. (UK)

16955 NUCLEAR FUEL REPROCESSING BY NON-AQUEOUS METHODS. Muramatsu, T.; Sano, K. (Ebara Mfg. Co. Ltd., Tokyo (Japan)). Ehara Jiho; No. 89, 30-35(Sep 1974). (In Japanese).

The experimental facilities for nonaqueous reprocessing studies of spent nuclear fuels, especially highly burnup fuels from fast neutron breeder reactors, are outlines. These facilities were designed and installed over a period of about three years since 1967. They consist of (1) two fluidized bed reactors of uranium and plutonium, (2) an adsorption and desorption purifier of fluorides, (3) a distillation purifier, and (4) a pyrometallurgical apparatus. Experiences in designing and manufacturing fluorine-resistant equipment and hot laboratory technology are also briefly introduced together with a review of the papers dealing with such a process presented at Geneva Conference on Peaceful Uses of Atomic Energy or published in several countries. (auth)

16956 REMOVAL OF IODIDE FROM LiF–BeF_2 MELTS BY HF–H_2 SPARGING. An Application to Iodine Removal From Molten Salt Breeder Reactor Fuel. Baes, C. F. Jr. (Oak Ridge National Lab., TN); Wichner, R. P.; Bamberger, C. E.; Freasier, B. F. Nucl. Sci. Eng.; 56: No. 4, 399-410(Apr 1975).

The results of experiments in which iodine, dissolved as I^- in

$LiF–BeF_2$ melts, was stripped as HI by sparging with $HF–H_2$ mixtures have indicated that it may be possible to use such treatment to remove iodine from the molten fluoride mixtures used in molten salt reactor (MSR) fuels. This is of particular significance to MSR technology because it indirectly provides the means for removing a significant fraction of ^{135}Xe, a decay daughter of ^{135}I. Data obtained from transpiration experiments indicated a linear decrease of the logarithm of the iodine concentration of the melt with the number of moles of HF passed, and a linear increase of the reciprocal of the apparent equilibrium quotient Q'/sub app/ equals P/sub HI//(P/sub HF/ [I^-]) with the partial pressure of HF in the sparge gas. The iodine removal mechanism is explained by a model which assumes that the rate-controlling step is the transport of I^- from the bulk of the melt to the surface and that the rates of the other steps are rapid. The removal of iodine from a molten salt breeder reactor (MSBR) fuel was analyzed in terms of the redox potential required to remove the iodine efficiently while preventing undesirable reactions in the fuel or between the fuel and its environment. The relative abundances of different iodine species present in the off-gas during sparging of an MSBR fuel were estimated; as expected, the results indicated a strong dependence on the temperature and hydrogen partial pressure. Low hydrogen pressures and low temperatures favor the formation of molecular iodine. High temperatures and low hydrogen pressures favor the formation of atomic iodine, while HI is formed at high temperatures and relatively higher hydrogen pressures. (auth)

CONTROLLED THERMONUCLEAR RESEARCH

Refer also to abstract 18383.

16957 (TRITA-EPP-74-28) INDEX AND ABSTRACTS 1974 OF REPORTS FROM THE DEPARTMENTS OF ELECTRON- AND PLASMA PHYSICS. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Electronfysik). Mar 1975. 36p. Dep. NTIS (US Sales Only) $5.00.

Abstracts of TRITA-EPP-74 reports 01 to 27 are given, with an index of reports which have recently appeared in print. A list of internal reports is also included. (SW)

16958 TECHNOLOGY INDEX FOR PLASMAPHYSICS RESEARCH AND FUSION REACTORS. Volume 9, No. 1, 1975. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 50p.

Plasma Confinement and Heating

Refer also to abstracts 16996 and 18283.

16959 (COO-2277-6) HIGH BETA CAPTURE AND MIRROR CONFINEMENT OF LASER PRODUCED PLASMAS. Semiannual Report, February 1, 1975–June 30, 1975. Haught, A. F.; Polk, D. H.; Fader, W. J.; Tomlinson, R. G.; Jong, R. A.; Ard, W. B.; Mensing, A. E.; Churchill, T. L.; Stufflebeam, J. H. (United Technologies Research Center, East Hartford, Conn. (USA)). Jun 1975. Contract E(11-1)-2277. 95p. Dep NTIS $7.75.

During the current report period, plasma production and confinement experiments were carried out in the experiment chamber, the neutral beam line ion source and neutralizer components operated in test stand configuration, the beam line and experiment chamber assembled as the integrated LITE facility for neutral injection experiments on the confined target plasma, and development of the system operation carried out in a number of areas including the demonstration of vacuum particle capture. Using two beam illumination, plasma production using LiH particles $\geq 100\ \mu m$ diameter have resulted in the generation of symmetric, fully ionized plasmas with average energies > 500 eV containing > 10^{16} hydrogen ions. On the basis of Fokker-Planck and rate equation calculations of the target plasma buildup, these plasmas meet the laser-produced plasma requirements for the LITE neutral injection experiments. Confinement investigations with these plasmas, using more refined microwave interferometer diagnostics to follow the plasma density time history, display an initial plasma decay with n_e values > 10^9 and plasma at densities > 10^{12} cm^{-3} observed for times > 600 μsec. The LITE neutral beam line was assembled and operated as a beam line test stand for check-out of the beam line components and is now incorporated as an integral part of the full LITE facility. The ion source was operated at extraction potentials up to 15 keV with total beam currents of 900 mA. The cross-flow water vapor neutralizer provides a neutralization efficiency of ~ 70%, and with the beam line assembled onto the confinement chamber, neutral beam currents > 3 mA/cm^2 (300 mA over the 100 cm^2 area of the confined plasma) at 14 keV are obtained at the center of the confinement region. The neutral beam system and its operation are described. (MOW)

16960 (IPPJ-202) AN ADIABATIC rf PLUGGING SCHEME FOR A CONTROLLED FUSION REACTOR. Hatori, T.; Watanabe, T.; Obayashi, H.; Sato, T.; Hiroe, S. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Oct 1974. 17p. INIS. NTIS (US Sales Only) $4.00.

The concept of the adiabatic rf plugging applied to the cusp system has been investigated both theoretically and experimentally. In the line and point cusps the plasma dimension across the magnetic field can be as small as order of the ion Larmor radius. In such thin plasmas the rf electric field can be excited efficiently. The condition for the rf field to form a quasi-potential barrier against a charged particle is discussed theoretically. The structure of this quasi-potential is also demonstrated by various experiments done with a simple cusp device. Based on these features a new scheme of plasma confinement system, composed of a straight cylinder terminated by magnetic cusps with the adiabatic rf plugs, is proposed as a possible prototype of the fusion reactor. This system is characterized by the moderate operating temperature, the impurity-free confinement, and no loss cone instabilities. The power balance problem is considered. (auth)

16961 (MATT-1139) NEW 200 kW, 800 MHz TRANSMITTER SYSTEM FOR LOWER HYBRID HEATING. Deitz, A. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract AT(11-1)-3073. 16p. Dep. NTIS $4.00.

A new rf heating system which has just been completed and is being installed on the ATC machine is described. The system utilizes four uhf TV klystrons to generate at least 200 kW of power at a frequency of 800 MHz. Pulse widths can be varied from 20 mu sec. up to 20 msec. A radar type floating deck modulator along with photo-optical transmitting and receiving devices have been incorporated into the system to provide the pulse fidelity and versatility which characterizes this equipment. Modular construction was emphasized in the design, when possible, to reduce maintenance and down time in the advent of component failure. Hybrid combining techniques are utilized in order to provide two 100 kW feeds into the machine. (auth)

16962 (N-75-10798) ION HEATING IN A PLASMA FOCUS. Hohl, F.; Gary, S. P. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Nov 1974. 30p. (NASA-TN-D-7765; L-9767). NTIS $3.75.

Ion acceleration and heating in a plasma focus were investigated by the numerical integration of the three-dimensional equations of motion. The electric and magnetic fields given were derived from experimental data. The results obtained show that during the collapse phase of focus formation, ions are efficiently heated to temperatures of several keV. During the phase of rapid current reduction, ions are accelerated to large velocities in the axial direction. The results obtained with the model are in general agreement with experimental results. (auth)

16963 (NP-20496) HEATING AND CONTAINMENT OF A PLASMA IN A SMALL TOKAMAK DEVICE. de Kluiver, H.; Piekaar, H. W. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica). Dec 1974. 8p. Dep. NTIS (US Sales Only) $4.00.

The Turbulently Heated Tokamak (TORTURE) at Jutphaas is described. This device will demonstrate whether or not efficient turbulent heating is possible in toroidal devices. The machine is described in terms of its stability and confinement properties, magnetic field configuration, power requirements, and cost. (MOW)

16964 EXPERIMENTAL INVESTIGATIONS OF ANOMALOUS ABSORPTION OF ELECTROMAGNETIC WAVES AND THE HEATING OF A COLLISIONLESS, NONMAGNETIZED PLASMA. Barinov, V. I.; Gekker, I. R.; Sergeichev, K. F.; Sizukhin, O. V.; Trofimov, V. E. pp 37-86 of Eksperimentla'nye issledovaniia anomal'nogo pogloshcheniia elektromagnitnykh voln i nagreva besstolknovitel'noi nezamagnichennoi plazmy. Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The present work reviews some recent experimental studies of the nonlinear interaction of electromagnetic waves with a fully ionized, collisionless, nonmagnetized plasma. For an SHF field strength exceeding 10 to 100 V/cm, strong anomalous absorption of EM waves in a plasma is observed accompanied by intense heating of the plasma, which cannot be explained by Coulomb collisions. Experimental relationships are presented which illustrate SHF absorption in a plasma, plasma particle heating, and plasma decay. It is attempted to explain the observed phenomenon from the viewpoint of the development of a parametric instability of a plasma placed in a strong SHF field. Results are given which supply boundary values for plasma concentration for the realization of radiation acceleration of plasma blobs and plasma containment in SHF traps. (IAA)

16965 EQUIPMENT FOR STABLE MAGNETIC CONFINEMENT OF AN IONIZED GAS COLUMN. (to Ultra-Centrifuge Nederland N. V.). Netherlands Patent 7,302,102/A/. 15 Feb 1973. 27p. (In Dutch).

Equipment for stable magnetic confinement of a plasma column is described. The current from the wall of a tube to a central anode together with a longitudinal magnetic field causes a fast rotation of the gas column consisting of a heavy and a light component. The cathode is a series of sharp needles or sharp laminar rings causing a corona discharge and at the same time reducing the friction at the walls to negligible values. At the end of the columns an isolated rotor inhibits electrical and mechanical short cuts. The invention can be applied to separation of isotopes by introducing an internal circulation of the heavy gases longitudinal along the wall of the tube. In addition applications for thermonuclear devices are possible. (auth)

16966 INTERACTION OF A 15-kJ RELATIVISTIC ELECTRON BEAM WITH A MIRROR-CONFINED PLASMA. Miller, P.A.

(Sandia Laboratories, Albuquerque, New Mexico 87115). Appl. Phys. Lett. 27: No. 3, 107-109 (1 Aug 1975).

The interaction of an intense relativistic electron beam with a mirror-confined plasma was studied. Beam parameters were nominally 600 kV, 300 kA, and 15 kJ. A 12-cm-diam cold hydrogen target plasma with $n_e \sim 2\times10^{13}/cm^3$ was preformed in a 2:1 mirror system with a mirror spacing of 50 cm and peak mirror field of 0.8 T. Background fill pressures from 1 to 50 mTorr were used. Beam transport through the plasma was good and net current levels were low. Energy deposition levels were near 2×10^{17} eV/cm^3, consistent with expectations based on previous work. The use of tantalum anodes in order to increase the beam's transverse velocity was found to quench the strong beam-plasma interaction. (auth)

16967 EFFECT OF IMPURITIES ON LOWER HYBRID HEATING OF A TOROIDAL HYDROGEN PLASMA. Kritz, H. (Hunter Coll., New York); Elridge, O. Nucl. Fusion; 15: No. 3, 465-470(Jun 1975).

Variations in the peak electron density and in the impurity concentrations cause significant shifts in the location of the lower hybrid resonance in a hydrogen plasma for a given incident wave frequency. Moreover, small variations in the impurity concentration can result in violation of the accessibility condition. Numerical results are presented which indicate these phenomena. (auth)

16968 NEUTRAL INJECTION HEATING OF A TOKAMAK PLASMA: THEORY AND EXPERIMENT. Cordey, J. G.; Gorbunov, E. P.; Hugill, J.; Paul, J. W. M.; Sheffield, J.; Speth, E.; Stott, P. E.; Tereshin, V. I. (Culham Lab., Abingdon, Eng.). Nucl. Fusion; 15: No. 3, 441-451(Jun 1975).

A powerful beam of neutral hydrogen is injected tangentially into the plasma produced in the Cleo-Tokamak apparatus. The effect on the macroscopic parameters of the plasma and on the equilibirum are found to be small. The energy spectrum of the resulting fast ions contained in the plasma is deduced from measurements of tangentially emitted charge-exchange neutrals. The results for injection parallel and anti-parallel to the plasma current are compared with a classical theoretical model, and good agreement is obtained. Measurements of the perpendicular energy spectrum of "plasma ions" show that the bulk of the ions are heated by about 10%, and that the low-energy ion distribution has a "tail", which is consistent with the spectrum of decelerated injected ions. (auth)

16969 CONTROL OF RE-CYCLING AND IMPURITIES IN THE ATC TOKAMAK BY MEANS OF GETTERED SURFACES. Stott, P. E.; Daughney, C. C.; Ellis, R. A. Jr. (Princeton Univ., NJ). Contract AT(11-1)-3073. Nucl. Fusion; 15: No. 3, 431-439 (Jun 1975).

A simple technique for reducing the re-cycling rate and impurity concentration in a tokamak plasma is described. An active metal coating, in this case titanium, evaporated onto the surface of the vacuum vessel, provides a trap for neutral hydrogen and impurity atoms which would otherwise freely penetrate the plasma. With this treatment, the plasma density decays with time after the ionization of the initial filling gas is completed, in contrast to typical standard discharges which have a rising density throughout the entire period of the discharge, indicating a large gas influx. These discharges are observed to have resistances close to that of a pure hydrogen plasma, $Z_{eff} \simeq 1.0$. There is a corresponding reduction in the intensity of highly ionized spectral lines of oxygen and iron as evidence of reduced impurity concentrations. The value of the effective ion charge, Z_{eff}, can be varied, by pulsing controlled amounts of impurity gases into the hydrogen plasma. (auth)

16970 LASER-BEAM PROPAGATION IN A LONG SOLENOID. Mani, S. A.; Eninger, J. E.; Wallace, J. (Avco Everett Research Lab., Inc., MA). Nucl. Fusion; 15: No. 3, 371-375(Jun 1975).

An analysis of the propagation of a laser beam in a cylindrical magnetically confined plasma with parabolic density profile is presented. The normal modes which are self-trapped are given. It is found that the largest mode that can be trapped by the plasma is given by $(1/2)\,(R_0^2/w^2-1)$ where R_0 is the radius of the plasma column and w is the fundamental mode width. It is found that all the trapped modes in a finite plasma can easily propagate distances of the order of one kilometer. An exact solution for the amplitude of the electric field for an incident Gaussian beam has been obtained. The solution exhibits alternate focusing and defocusing of the beam. The effect of this on the plasma heating is discussed. (auth)

16971 PRELIMINARY EXPERIMENTS ON THE PLASMA EQUILIBRIUM WITH A THREE-DIMENSIONAL MAGNETIC AXIS (ASPERATOR-K). Koyama, K.; Nagao, S. (Tohoku Univ., Sendai (Japan). Faculty of Engineering); Suzuki, Y. J. Phys. Soc. Jap.; 37: No. 1, 209-213(Jul 1974).

Preliminary experiments with Asperator-K which has a three dimensional magnetic axis are reported. The plasma column was confined in a magnetic field of 90°-toroidal sector with a helical axis which had $n\epsilon \cong 0.8$ where n is the number of periods around the torus and ϵ is the ratio of the amplitude of the helix of the magnetic axis to the major radius of the torus R. The measured rotational transform angle was $(0.8 \pm 0.2)\pi$ per period. The stabilization effect by the end plates was not observed. The displacement of the plasma column was −0.5 cm with respect to the direction of the principal normal of the magnetic axis. This value is not far from the theoretical prediction. (auth)

16972 PLASMA HEATING BY ION WAVE INSTABILITY IN Q-MACHINE. Watanabe, S.; Tanaca, H. (Yokohama National Univ. (Japan)). J. Phys. Soc. Jap.; 36: No. 6, 1661-1666(Jun 1974).

The heating of electrons and ions by the current driven ion wave instability was studied in a Q-machine. The heating occurred when the ion wave sufficiently grew and steepened, i.e., in a certain turbulent state. The heating mechanism is not clear, but the heating by means of the ion wave was experimentally confirmed. (auth)

16973 ANOMALOUS ION HEATING IN A PARAMETRICALLY UNSTABLE PLASMA. Baikov, I.S.; Silin, V.P. (P. N. Lebedev Institute of Physics, Academy of Sciences of the USSR, Moscow). Sov. Phys.–Tech. Phys. 19: No. 12, 1529-1533 (June 1975).

Anomalous ion heating is investigated in a plasma driven by an ac electric field with a frequency near the electron plasma frequency. The anomalous heating is due to the coupling between the external electric field and the plasma caused by ion-acoustic fluctuations; these grow exponentially in the parametric instability and are the cause of anomalous ion heating in a plasma with $T_e \gtrsim T_i$ when strong absorption of the ion-acoustic oscillations occurs. (auth)

16974 ANISOTROPIC PLASMA HEATING NEAR THE LOWER HYBRID FREQUENCY. Glagolev, V.M.; Martynenko, V.V.; Skosyrev, Yu.V. Sov. Phys.–Tech. Phys. 19: No. 12, 1543-1546 (June 1975).

The ion and electron energy components associated with the transverse and longitudinal motion with respect to a fixed magnetic field are measured in the heating of a plasma with a density of 10^{12} cm^{-3} at a frequency near the lower hybrid frequency. The transverse energy of the particles is determined with a multigrid probe which measures the currents parallel to the magnetic field. The method for finding the energy is based on the effect of the magnetic field at the probe on the voltage—current characteristics of the probe. The plasma is heated by the excitation of ordinary and extraordinary waves at the plasma surface by means of a coupling loop and the subsequent transformation of these waves into plasma waves. Measurements show that the average ion energy associated with the motion across the magnetic field is equal to the total transverse energy of the plasma found from the diamagnetic signal. Thus, the transverse energy of the ion component increases in the heating process. The average ion energy, measured from the spectrum of charge-exchange neutrals over the range 0.5-3 keV, is 250 eV, in good agreement with the results obtained by the method described above. The transverse electron energy is much lower than the transverse ion energy. It is found experimentally that both transverse and longitudinal ion heating occur in a homogeneous magnetic field. (auth)

Plasma Diagnostics

Refer also to abstract 18300.

16975 (EUR-CEA-FC-759) THOMSON SCATTERING DEVICE AND DATA ACQUISITION SYSTEM FOR TFR. Charet, M.; Dumay, L.; De Michelis, C.; Platz, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Feb 1975. 33p. Dep. NTIS (US Sales Only) $4.75.

The first part of this report describes the optical and spectroscopic layout of a Thomson scattering system. This includes a high power Ruby laser, a grating spectrum analyzer, laser-to-plasma and plasma-to-analyzer matching optics. The second part is devoted to the deduction of scattering spectra from photomultiplier signals. Two procedures are described. The first, rather classical one is based on CRT recordings. The second one is fully automatic and computer-assisted. Calibration problems are also treated. Finally, examples of scattering spectra, temperature and density profiles obtained from the plasma of the TFR Tokamak are given. (auth)

16976 DETERMINATION OF THE DENSITY PROFILE OF A PLASMA OF TOKAMAK TYPE BY MILLIMETER-WAVE MULTICHANNEL INTERFEROMETRY. Lisitano, G. (Max-Planck-Institut fuer Plasmaphysik, GmbH, Garching, Ger.); Gottardi, N.; Cannici, B.; Conti, F.; Gattinoni, G.; Miccoli,

E.; Perina, R.; Spizzamiglio, A. Alta Freq.; 43: 560-564 (Aug 1974). (In Italian).

The distribution of the electron density in a toroidal machine of the Tokamak type was studied. The desired distribution was determined by an Abelian type graphic-numerical transformation of the mean plasma density obtained by eight millimeter-wave interferometric channels under the assumption that the plasma density distribution is symmetrical with respect to the equatorial plane of the Tokamak and that the mean density profile of the toroidal discharge tube reflects the local density profile. (IAA)

16977 MEASUREMENT OF THE RADIAL ION TEMPERATURE DISTRIBUTION IN A LOW-DENSITY PLASMA. Hafez, L. A.; Deschamps, P.; Platz, P. (CEN, Fontenay-aux-Roses, France). J. Phys., D (London); 8: No. 4, 374-382(11 Mar 1975).

Density and temperature profiles (for both ions and electrons) and plasma rotation measurements are required for a detailed comparison between the properties of collisionless drift waves obtained with hydrogen plasma on the ODE experiment and the linear theory. Whenever these quantities cannot be measured by the simple electrostatic probe technique it is necessary to turn to spectroscopic techniques. Such a technique has been used here, and very accurate measurements of the Doppler broadening of the H_β line at 4862 Å (H atoms being heated by charge exchange) give the ion temperature radial profiles for different experimental conditions in a low-density plasma ($n = 10^9$ to 10^{10} cm^{-3}, $T_e = 13$ eV, $T_i = 1$ eV, and $B_0 = 1$ to 3 kG). The improved spectroscopic system used is sufficiently sensitive for the plasma rotation to be measured where the azimuthal velocity is 10 times lower than the ion thermal velocity. This observation confirms the existence of a radial electric field E(r) in the plasma. The measurement of the rotation enables the frequency shifts of the unstable oscillations occurring in the laboratory frame to be investigated and an observed flute-type instability to be attributed to the centrifugal force arising from this $E \times B$ drift motion. (auth)

16978 MEASURING THE CONCENTRATION OF PLASMA WITH THE HELP OF A SUBMILLIMETER LASER. Malykh, N. I.; Yampol'skti, E. S.; Malykh, L. Ya.; Tarasevich, A. I. (Inst. of Physics and Tech., Sukhumi, USSR). Teplofiz. Vys. Temp.; 12: No. 3, 492-496(1974). (In Russian).

The measuring of plasma concentration with the help of a three-mirror interferometer on a laser working on the wave length of 337μ is discussed by reference to the scheme of the interferometer and its working principle. Oscillograms showing the modulation of the signal of the laser and the changes of concentration and of the amplitude of interference are analyzed. The concentrations were measured in the limits of 10^{13} to 5×10^{15} cm^{-3}, the maximum measured concentration was $n_{max} = 10^{16}$ cm^{-3}, the minimum measured concentration was $n_{min} = 2 \times 10^{12}$ cm^{-3}, when a minimum measurable phase shift angle $\psi_{min} = 0.1\pi$ and an 80-mm diameter of the plasma column are assumed. (JPRS)

16979 SUBNANOSECOND MICROSCOPIC HOLOGRAPHIC INTERFEROMETRY OF PLASMAS PRODUCED BY 1-nsec CO_2 LASER PULSES. Fedosejevs, R.; Richardson, M.C. (Division of Physics, National Research Council of Canada, Ottawa, Ontario, Canada). Appl. Phys. Lett. 27: No. 3, 115-117 (1 Aug 1975).

Two-dimensional distributions of the electron density within plasmas produced by 1-nsec-duration high-intensity ($> 10^{13}$ W/cm^2) CO_2 laser pulses on solid polyethylene targets have been obtained with the aid of microscopic holographic interferometry. Short 700-psec pulses, derived from a synchronized ruby laser, were used to illuminate the interferometric system, which had a spatial resolution of ~ 10 μ. (auth)

16980 SHEATH GROWTH IN A FLOWING HIGH-PRESSURE PLASMA. Oliver, B. M.; Clements, R. M. (Victoria Univ., British Columbia). J. Phys., D (London); 8: No. 8, 914-921 (1 Jun 1975).

Experimental measurements of sheath thickness and sheath growth in an unseeded atmospheric-pressure flame plasma of ionization density $\approx 10^{18}$ m^{-3} and electron temperature ≈ 1800 K have been compared with analytical solutions for these parameters. The analysis is an extension of that of Clements and Smy (IEEE Trans. Instrum. Meas. 1M-19 167-71 (1970)) which allows for finite probe size and plasma flow velocity. The results, which are applicable for large sheath formation on the upstream side of a cylindrical probe, are in good agreement with theoretical predictions. (auth)

16981 STATIONARY CHARACTERISTICS OF LONG-DURATION DISCHARGES IN THE TFR TOKAMAK. Nucl. Fusion; 15: No. 3, 550-551(Jun 1975).

A maximum number of available diagnostic techniques were simultaneously operated to study the plasma of these discharges with emphasis of the central time interval of high current. These techniques include: ruby-laser scattering, microwave interferometry, HCN laser interferometry, soft x-ray emission and electron synchrotron emission measurements, analysis of fast neutrals, uv spectroscopy, and magnetic loops. Data are given for discharges with 220 kA maximum plasma current. (MOW)

16982 THOMSON-SCATTERING DENSITY MEASUREMENTS IN 2XII AT LOW MAGNETIC GUIDE FIELDS. Simonen, T. C. (Lawrence Livermore Lab., CA). Nucl. Fusion; 15: No. 3, 542-543(Jun 1975).

Results are reported of an investigation into the compression of deuterium plasma with low guide fields, $B_0 = 0.5$ and 1kG. Average plasma parameters are listed for these cases. A figure shows the measured diameter at 400 μ sec (at the peak of a 4.5 kG pulsed field) versus the magnetic field strength. The plasma diameter at low guide fields is discussed in terms of the following: (1) Coulomb end-loss scattering, (2) high-beta radial plasma expansion, (3) radial plasma diffusion, and (4) wall interactions. (MOW)

16983 HOT PROBE MEASUREMENTS IN A RAREFIED STREAMING PLASMA. Netsvetailov, E.M.; Nosachev, L.V.; Skvortsov, V.V. Sov. Phys.—Tech. Phys. 19: No. 12, 1579-1583 (June 1975).

An experimental and theoretical investigation has been made of the error in the readings of a hot probe, as a function of the parameters of the surrounding medium and the emitter operating conditions. The case in which the probe current is electron space-charge-limited, the energy of directed motion of the ions is appreciably larger than the plasma potential, and the electron distribution in the plasma is Maxwellian is treated. The problem has been solved numerically in the one-dimensional case. From an analysis of the results an approximate equation is found for the potential barrier near the probe emitter surface. The results show that the thermionic electron component of the volt—ampere characteristic must have two asymptotes on a semilogarithmic scale. The point of intersection of the asymptotes gives the plasma potential with high accuracy. A method is described for constructing the potential field in a flow using a hot probe; it is based on a combination of the asymptote intersection method and the widely-used method for determining the potential of a plasma from the point of intersection of the characteristics of hot and cold probes. The combination method gives good accuracy with comparatively small effort. (auth)

16984 PLASMA ION DIAGNOSTICS USING RESONANT FLUORESCENCE. Stern, R.A. (Bell Laboratories, Murray Hill, New Jersey 07974); Johnson, J.A. III. Phys. Rev. Lett. 34: No. 25, 1548-1551 (23 June 1975).

Laser-induced fluorescence of ionic states is used to measure local ion densities and velocities in argon plasmas. (auth)

Plasma Kinetics (General)

16985 (AD/A-000543) CHARGED COLLOIDAL PARTICLES FOR CONTROLLED NUCLEAR REACTORS. Final Report. Hendricks, C. D. (Illinois Univ., Urbana (USA). Charged Particle Research Lab.). Aug 1974. 28p. (CPRL-1-74; UILU-ENG-74-2551; AFOSR-TR-74-1584). NTIS $3.75.

Charge and mass loss of macroscopic particles in a weakly ionized plasma were measured. The evaporation and combustion theories of droplets were surveyed and the interaction of charged droplets with the ions in a flame was investigated. Cryogenic techniques in producing particles of oxygen, hydrogen, argon and other materials in vacuum were developed. These particles were injected into plasmas as a diagnostic tool to measure plasma parameters. A dense plasma focus device is under construction to investigate the possibility of increasing the output of pulsed x-rays from the DPF device by injecting particles into the focus region. (auth)

16986 (N-75-10799) MAGNETOGASDYNAMIC COMPRESSION OF A COAXIAL PLASMA ACCELERATOR FLOW FOR MICROMETEOROID SIMULATION. Igenbergs, E. B.; Shriver, E. L. (National Aeronautics and Space Administration, Huntsville, Ala. (USA). George C. Marshall Space Flight Center). Oct 1974. 64p. (NASA-TR-R-435; M-465). NTIS $4.25.

A new configuration of a coaxial plasma accelerator with self-energized magnetic compressor coil attached is described. It is shown that the circuit may be treated theoretically by analyzing an equivalent circuit mesh. The results obtained from the theoretical analysis compare favorably with the results measured experimentally. Using this accelerator configuration, glass beads of 125 micron diameter were accelerated to velocities as high as 11 kilometers per second, while 700 micron diameter glass beads were accelerated to velocities as high as 5 kilometers per second. The velocities are within the hypervelocity regime of meteoroids. (auth)

16987 (TRITA-EPP-74-19) BALANCE OF ROTATING PLASMA SLABS. Hellsten, T. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). Nov 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

Numerical solutions were obtained for the balance of single and multicomponent plasmas in long cylindrical as well as plane slab geometry. In the special case of a hydrogen-deuterium mixture, a separation degree of about 12 was obtained at a plasma flux of 6.3×10^{21} ions/ms and a power input of 2.4×10^{6} W/m. (auth)

16988 (TRITA-EPP-74-20) FLUX OF PARTICLE LOSS IN A PERMEABLE PLASMA. Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). 6 Nov 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

An analysis was made of the steady-state flux of particle loss to collectors placed at the boundary of a magnetically confined plasma being permeable to neutral gas. This loss, as well as the particle "confinement" time τ_p defined from it, does not depend in a straightforward way on the plasma temperature and the particular mechanisms of plasma diffusion, but is also a function of the plasma sources due to ionization and their effects on the spatial plasma pressure distribution. In particular, for a class of spatially similar temperature distributions with varying maximum temperature T_0, the neutral gas interaction can sometimes lead to "Bohm-like" values of τ_p even if the real particle losses are due to classical diffusion. (auth)

16989 (TRITA-EPP-74-104) EXPERIMENTAL STUDIES OF A MAGNETISED PLASMA. Progress Report 1974. Faelthammar, C. -G.; Lindberg, L.; Karlson, E. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). 1975. 18p. (In Swedish). Dep. NTIS (US Sales Only) $4.00.

The research activities at the Department of Plasma Physics during 1974 which are supported by the Swedish Atomic Research Council are described. The projects concerned the interaction of a moving plasma with a neutral gas (in which the electron temperature is found to increase very rapidly), the interaction of a plasma beam with solid matter, motion of a plasma beam into a curved magnetic field and the adiabatic motion of finite plasma streams in inhomogeneous magnetic fields. Instrumentation has been developed for time resolved spectroscopy using image amplifier technique, and an ion beam probe with a special wide angle ion analyzer has been developed. (SW)

16990 ABSORPTION COEFFICIENT OF THE SPECTRAL LINES OF NITROGEN IN AN AIR PLASMA. Babenya, L. A. Zh. Prikl. Spektrosk.; 22: No. 2, 215-219(Feb 1975). (In Russian).

To investigate the kinetics of plasma heating and production by means of laser radiation, it is necessary to have available information on the spectral absorption coefficients of the corresponding plasma. Within the framework of semiclassical, nonadiabatic shock theory a calculation is carried out of the parameter of Stark broadening and of the absorption coefficient of the spectral lines of neutral nitrogen in an air plasma at atmospheric pressure in the temperature region from 8000 to 15,000°K. (SJR)

16991 RADIATION PRESSURE EFFECTS PRODUCED BY WAVE PACKETS IN PLASMAS. Klima, R.; Petrzilka, V. A. (Ceskoslovenska Akademie Ved, Prague). J. Phys., A (London); 8: No. 5, 829-837(May 1975).

An obliquely impinging electromagnetic wave exerts a negative radiation pressure on an abrupt plasma-vacuum boundary. The radiation pressure on a conductor immersed in plasma consists of an electromagnetic part and a mechanical part. The equation of motion of a quasi-particle corresponding to a wave packet is derived. The time-averaged motion of a charged particle in a non-monochromatic wave packet is given. No assumption is made concerning the validity of Abraham or Minkowski momentum densities. (auth)

16992 PLASMA DENSITY IN A MAGNETOPLASMA COMPRESSOR. Vinogradova, A. K.; Vinogradov, V. P.; Morozov, A. I.; Sergeev, A. A. Sov. Phys.-Tech. Phys.; 19: No. 3, 421-423(Sep 1974).

Translated from Zh. Tekh. Fiz.; 44: No. 668-671(Mar 1974).

The plasma density distribution is measured in the gap between the electrodes and at the focus in a magneto-plasma compressor by means of a Michelson interferometer with time resolution. The process is shown to be quasisteady-state; oscillations occur and are particularly intense when neutron emission is observed. (auth)

16993 CONTRACTION OF A PLASMA WITH A CURRENT FAR FROM EQUILIBRIUM. Atrazhev, V. M.; Yakubov, I. T. Zh. Prikl. Mekh. Tekh. Fiz.; No. 1, 45-54(1975). (In Russian).

Contraction is an inhomogeneous plasma state where the plasma is detached from the walls, and is concentrated into a more or less narrow layer, through which the current flows. The contraction is a result of the development of an instability of an initial homogeneous state, and may be connected with the existence of a region having volt-ampere characteristics with a negative differential conductivity. This phenomenon is known in semiconductor physics where various mechanisms of instabilities leading to contraction have been investigated. In a low-temperature plasma a thermal contraction is well known that is connected with a superheated instability of an electron gas. This study investigates a plasma far from equilibrium, in which contraction can occur as a result of disproportionation in the balance of the number of electrons, that is, it has a recombination-ionization character. Consideration is given to the homogeneous state of a non-equilibrium, weakly-ionized plasma having a charged particle concentration n_e of 10^{11} to $10^{13}/cm^3$ (electron temperature T is on the order of a few thousand degrees Centigrade; the gas is cold). Nonequilibrium is caused by the emission of radiation out of the boundaries of the plasma volume. As a result of instability the plasma may transfer into a inhomogeneous (contracted) state, which is considered under conditions where joule electron heating is compensated by losses during elastic collisions with gas atoms. Charge diffusion plays the main role in forming the boundary separating the plasma with current and the current-free region. The electron thermal conductivity is also taken into account. More complicated are the conditions in which the radiation energy losses are also substantial, and superheating is possible along with ionization instability. This subject is discussed briefly. (SJR).

16994 ENERGY LOSSES FROM STRONG ELECTRON RINGS TRAPPED IN RECE-BERTA. Smith, A. C. Jr.; Swannack, C. E.; Fleischmann, H. H.; Phelps, D. A. (Cornell Univ., Ithaca, NY). Nucl. Fusion; 15: No. 3, 547-549(Jun 1975).

Some experiments to measure energy losses are described. A small 0.025-mm-dia tungsten filament with a small lead weight was suspended from a rod at the top of the vacuum chamber and stretched across the vertical radius of the tank to the center chamber. The average energy loss for 500-keV electrons penetrating the wire is 35 keV, and the corresponding multiple scattering angle is 60°. The forward-directed bremsstrahlung produced by electrons hitting the wire were observed by three scintillation-photomultiplier combinations. Some data are described. (MOW)

Plasma Kinetics (Experimental)

16995 (N-74-34199) X-RAY EMISSION FROM HIGH-TEMPERATURE PLASMAS. Final Technical Report. Harries, W. L. (Old Dominion Univ., Norfolk, Va. (USA). Research Foundation). Jul 1974. Contract NAS1-11707. 67p. (NASA-CR-132500). NTIS $3.75.

X-rays from a 25-hJ plasma focus apparatus were observed with pinhole cameras. The cameras consist of 0.4 mm diameter pinholes in 2 cm thick lead housing enclosing an x-ray intensifying screen at the image plane. Pictures recorded through thin aluminum foils or plastic sheets for x-ray energies sub gamma smaller than 15 keV show distributed x-ray emissions from the focussed plasma and from the anode surface. However, when thick absorbers are used, radial filamentary structure in the x-ray emission from the anode surface is revealed. Occasionally larger structures are observed in addition to the filaments. Possible mechanisms for the filamentary structure are discussed. (auth)

16996 PLASMA BEHAVIOR IN MAGNETIC FIELD CONFIGURATIONS CREATED BY PERMANENT MAGNETS. Geode, A. P. H.; Brakenhoff, H. J.; Massmann, P. (Stichting voor Fundamenteeel Onderzoek der Materie, Amsterdam). pp 71-97 of Ion Beam Plasma Interaction. The Production of a Quiescent Plasma. Goede, A. P. H. Amsterdam; Amsterdam Univ. (16 Apr 1975).

A plasma can be stabilized effectively in an average minimum-B type magnetic field created with the help of permanent magnets. Measurements of the spatial distribution of noise level, density and electron temperature were done in steady state. These results are compared with analogous measurements in two other types of field configuration: a magnetic mirror field and an Ioffe-type minimum B-field, the latter obtained also with application of permanent magnets. In the second part of this chapter, the confinement properties of the three field configurations are measured and compared. A theoretical model to interpret the results is discussed. (NL)

16997 ENERGY BALANCE IN TOKAMAKS IN THE "PLATEAU—BANANA" TRANSITION REGION. Dnestrovskii, Yu.N.; Kostomarov, D.P. (Physics Faculty, M. V. Lomonosov Moscow State University). Sov. Phys.—Tech. Phys. 19: No. 12, 1541-1542 (June 1975).

The transition to a collisionless regime at large currents in modern Tokamaks is investigated by numerical integration of the energy-balance equations. It is shown that the presence of cold neutrals can reduce significantly the plasma ion temperature and impede the transition from the plateau regime to the banana regime. (auth)

Plasma Kinetics (Theoretical)

16998 (N-75-11742) SPOKE WAVENUMBERS AND MODE TRANSITIONS IN THE NASA LEWIS BUMPY TORUS. Gerdin, G. A. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 18p. (NASA-TM-X-71624). NTIS $3.25.

Waveforms of fluctuations of plasma potential, resulting from rotating electron and ion charge concentrations, were observed in a bumpy torus. Since these fluctuations were thought to be spoke rotations in the direction of the ExB drift, measuring the direction of spoke rotation should determine the direction of the electric fields over much of the plasma surface. A Langmuir probe was inserted into the plasma to measure the floating potential of the plasma, hence the direction of the electric field could be checked another way. (auth)

16999 (ORNL-TM-4948) TOROIDAL PLASMA ROTATION IN AXISYMMETRIC AND SLIGHTLY NON-AXISYMMETRIC SYSTEMS. Tsang, K. T.; Frieman, E. A. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 38p. Dep. NTIS $5.00.

The relaxation of toroidal plasma rotation in the intermediate and collisional regimes was calculated. The present results connect smoothly to previous results for the banana and collisional regimes. Small magnetic field ripples lead to a non-ambipolar ion flux which may significantly affect toroidal rotation in all three regimes. This was also calculated. (auth)

17000 (UCID-16830) VOA: A 2-D PLASMA PHYSICS CODE. Eltgroth, P. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 May 1975. Contract W-7405-Eng-48. 36p. Dep. NTIS $5.00.

A 2-dimensional relativistic plasma physics code has been written and tested. The non-thermal components of the particle distribution functions are represented by expansion into moments in momentum space. These moments are computed directly from numerical equations. Currently three species are included--electrons, ions and "beam electrons". The computer code runs on either the 7600 or STAR machines at LLL. Both the physics and the operation of the code are discussed. (auth)

17001 RADIATION FROM A SOURCE IN A COLD MAGNETOACTIVE PLASMA, REVISITED. Application to Cyclotron and Multipole Radiation. Hoyng, P.; Stevens, G. A. (Rijksuniversiteit, Utrecht). pp 123-156 of Studies on Hard X-Ray Emission From Solar Flares and on Cyclotron Radiation from a Cold Magnetoplasma. Hoyng, P. (ed.). Utrecht; Rijksuniversiteit (23 Jun 1975).

An analysis is presented of the radiation emitted by an arbitrary source in a cold magnetoactive plasma. The plasma is supposed to be infinite and homogeneous; its dielectric properties are described by a dielectric tensor ϵ. Expressions for the radiation fields are derived using the technique of Fourier-decomposition. An expression for the vector potential is constructed and elaborated as far as possible for an arbitrary current source. The approach differs from that in previous work in that the sequence in which the various integrations are carried out has been changed. The radiation flux is defined on the basis of Poynting's vector S; in the definition, there is a distinction between current sources behaving as a given function of time and randomly fluctuating sources. In the latter case, an ensemble average is used rather than a time average. The general result for the radiation flux is then specified for cyclotron radiation from a stationary ensemble of electrons and for multipole radiation. For both types of radiation, expressions are obtained that differ from those previously given. In the case of cyclotron radiation, e.g., there is a different harmonic frequency. The cause of these differences is indicated. Throughout the paper a compact notation could be used on the basis of the work of Bremmer. (auth)

17002 RELAXATION OF THE ELECTRON VELOCITY DISTRIBUTION FUNCTION IN HOMOGENEOUS FIELD-FREE LORENTZ PLASMA. Winkler, R. (Central Inst. for Electronphysics, Griefswald, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 293-317(Nov 1974). (In German).

For a homogeneous field-free Lorentz plasma, the time variation of the electron velocity distribution function, beginning with an arbitrarily chosen homogeneous initial value of the function, was completely calculated from the Boltzmann electron equation. Elastic collisions and an arbitrary number of exciting processes between the electrons and one of the neutral gas components, considered at rest before the collision, were regarded as uncorrelated two-collision interaction processes. The differential scattering cross sections describing the collision interaction were subjected to almost no limitations with respect to their velocity and scattering angle dependence. The studies were based on the complete spherical surface function development of the Boltzmann electron equation. On the basis of the solutions derived for the isotropic fraction and all anisotropic components of the electron velocity distribution function, the relaxation of all distribution function constituents was discussed. The effect of the various scattering angle dependence of the differential cross section on the relaxation mechanism of the electric velocity distribution function in the Lorentz plasma was stressed. (tr-auth)

17003 BREMSSTRAHLUNG OF HOT QUANTUM PLASMA. Kvasnica, J.; Horacek, J. (Charles Univ., Prague). Czech. J. Phys.; 25: No. 3, 325-329(1975).

The classical Debye field is replaced by the respective quantum modification for a hot quantum plasma. The bremsstrahlung spectrum and the total bremsstrahlung intensity are investigated in detail. The results of numerical calculations are tabulated vs. the characteristic parameter $\beta = h\omega_0/kT$, where ω_0 is the plasma frequency and other symbols have their standard meaning. It is found that the deviations from the bremsstrahlung of a classical plasma become significant for the values $\beta \gtrsim 10^{-2}$. These modifications are to be taken into consideration in the interpretation of the bremsstrahlung measurements. (auth)

17004 LOSS FACTOR STUDY. Pekarek, S. (Czech Technical Univ., Prague). Czech. J. Phys.; 25: No. 5, 521-525(1975).

The so-called "loss factor" for the case of a toroidal plasma accelerator is determined on the basis of the law of momentum conservation. This factor characterizes the influence of the remaining gas on the plasma movement. The magnitude of this factor is also determined experimentally. The low-pressure toroidal glow discharge situated in the moving magnetic field was used for the experiments. (auth)

17005 COLLECTIVE EMISSION PROCESSES IN UNMAGNETIZED PLASMAS. Bekefi, G. (Massachusetts Inst. of Tech., Cambridge). pp 1-111 of Plasma Physics: Les Houches 1972. New York; Gordon and Breach Science Publishers (1975).

The discussion is limited to highly ionized, almost collisionless (Vlasov) plasmas. The inclusion of collisions with atoms or even the presence of numerous large angle Coulomb collisions leads to difficulties many of which are neither well understood nor well studied. No externally applied magnetic field is allowed to act on the plasma. The presence of a magnetic field results in a whole host of additional modes of oscillation, time and length scales which spoil much of the intrinsic simplicity of the subject. (auth)

17006 ELECTRON THERMALIZATION IN A RECOMBINING PLASMA. Young, H.W.; Myers, G.H. (Chemistry Department, University of Florida, Gainesville, Florida 32611). Phys. Rev. A 11: No. 6, 2134-2137 (June 1975).

Electron temperatures different from neutral and ion temperatures can persist for appreciable periods in a low-density plasma decaying by dissociative recombination. Such temperature differences can be initially due to the process generating the plasma. The energy dependence of the recombination cross section can also result in an elevation of the electron temperature during the recombination process. The time dependence of the electron temperature and recombination rate is calculated for a variety of experimental conditions. Corrections to the observed recombination rate for these effects are important only if the dimensionless parameter $C = (16/3)(2m_e kT_A/\pi)^{1/2}$ $(n_A \sigma_{MT}/m_A n_e^0 \alpha_R^A)$ is less than unity. (T_A, n_A, and m_A are the neutral particle temperature, number density, and mass, respectively; n_e^0 and m_e the electron initial number density and mass; σ_{MT} the electron-neutral momentum-transfer cross section; and α_R^A the electron-ion dissociative recombination rate constant at $T_e = T_A$.) (auth)

17007 SUM RULES FOR NONLINEAR PLASMA RESPONSE FUNCTIONS. Golden, K.I. (Department of Electrical Engineering, Northeastern University, Boston, Massachusetts 02115); Kalman, G.; Datta, T. Phys. Rev. A 11: No. 6, 2147-2151 (June 1975).

The asymptotic high-frequency ($\omega \to \infty$) and static ($\omega = 0$) behavior of the quadratic longitudinal polarizability, combined with the Kramers-Kronig relations, leads to sum rules analogous to the linear "conductivity" and "compressibility" rules. Further, Kubo-type sum rules are derived by taking frequency moments of the nonlinear fluctuation-dissipation theorem; these lead to the external quadratic polarizability summing to static linear response functions. (auth)

17008 MULTI-GROUP DIFFUSION OF ENERGETIC CHARGED PARTICLES. Corman, E. G.; Loewe, W. E.; Copper, G. E.; Winslow, A. M. (Lawrence Livermore Lab., CA). Nucl. Fusion; 15: No. 3, 377-386(Jun 1975).

A multi-group diffusion method is derived for the slowing down and spatial transport of energetic positive ions in a hot plasma. A diffusion coefficient which is "flux-limited" is used to provide better accuracy when slowing-down is dominated by Coulomb collisions with electrons and the mean free path is long. This results in a fast, flexible, small-memory computer pgoram for calculating the behavior of energetic charged particles. Calculated results are presented for 3.5-MeV alpha-particles slowing down in a 50-keV deuterium-tritium plasma of uniform density. Various spatial distributions of the alpha-particle source were tested in spherical geometry nnd compared with the results of suitable Monte-Carlo calculations. Generally, fair to good agreement was obtained for the energy deposition in space and time with as few as ten energy groups, and good to excellent agreement was obtained with 100 groups. It was found that the multi-group method using 100 groups was appreciably faster than the Monte-Carlo method, while for only 10 groups it was at least an order of magnitude faster. This method is expected to give good results for temperature, density, and charged-particle source distributions which are typical of laser fusion reactors, and may also be applicable to certain astrophysical problems. (auth)

17009 CURRENT PENETRATION IN TOKAMAK-TYPE DISCHARGES. McBride, J. B.; Klein, H. H.; Byrne, R. N.; Krall, N. A. (Science Applications, Inc., La Jolla, CA). Contract AT(04-3)-1018. Nucl. Fusion; 15: No. 3, 393-405(Jun 1975).

A numerical-analytical study of current penetration in tokamak-type discharges is presented. Results presented include: (1) A survey of microinstabilities proposed as relevant to tokamak start-up; (2) an examination of the energy transport equations with toroidally enhanced classical thermal conduction to argue resistive penetration and scaling properties; (3) tabular and graphical data from a 1-D MHD code applied to cylindrical geometry for a variety of assumed start-up conditions. The transport included is classical resistance and toroidal classical thermal conduction radially. The results show that current penetration properties of fast-rise, low-density devices, such as ST, Doublet II and ORMAK, differ from those of slow-rise, high-density devices such as the planned PLT and Doublet III experiments. In the latter case, the electrons and ions can remain collisionally well coupled throughout the rise of the driving field, and ion thermal conductivity can frustrate the tendency of Joule heating near the plasma boundary to cause skin formation. It is further concluded that most of the microinstabilities proposed to explain "anomalous" current penetration will in practice never occur. (auth)

17010 NEOCLASSICAL THEORY OF COLLISIONAL TRANSPORT IN THE PRESENCE OF FUSION α-PARTICLES. Nocentini, A. (Univ., Trieste, Italy); Tessarotto, M.; Engelmann, F. Nucl. Fusion; 15: No. 3, 359-370(Jun 1975).

The neoclassical transport theory is developed for an axisymmetric toroidal plasma containing highly energetic α-particles as produced by fusion events. It is shown that the α-particle fluxes in this case have a weaker dependence on the aspect ratio than at lower energies since the prevailing collisional effect is a drag. The bootstrap current results to be reduced by the presence of fusion α-particles. (auth)

17011 OPTIMIZATION OF FUSION POWER DENSITY IN THE TWO-ENERGY-COMPONENT TOKAMAK REACTOR. Jassby, D. L. (Princeton Univ., NJ). Contract AT(11-1)-3073. Nucl. Fusion; 15: No. 3, 453-464(Jun 1975).

Fusion power density P_f is a critical parameter for certain fusion reactor applications such as fissile breeding. This paper considers the optimal plasma conditions for maximizing P_f in a beam-driven D-T tokamak reactor. Given $T_e = T_i$ and fixed total plasma pressure, there is an optimal $n_e\tau_E$ for maximizing P_f, i.e. $n_e\tau_E = 4 \times 10^{12}$ to 2×10^{13} cm^{-3} · s for $T_e = 3$ to 15 keV and 200-keV D beams. The corresponding $\bar{F}$ = (beam pressure/bulk-plasma pressure) is 0.96 to 0.70. P_{fmax} increases as T_e is reduced and can be an order of magnitude larger than the maximum P_f of a thermal reactor of the same beta, at any temperature. A lower practical limit to T_e may be set by requiring a minimum beam power multiplication Q_b. For the purpose of fissile breeding, the minimum $Q_b \sim 0.8$, requiring $T_e \gtrsim 4$ keV if $Z = 1$. The optimal operating conditions for obtaining P_{fmax} in a beam-driven reactor are considerably different from those for enhancing Q_b. Maximizing P_f requires restricting both T_e and $n_e\tau_E$, maintaining a bulk plasma markedly enriched in tritium, and spoiling confinement of fusion alphas. Provided that beam penetration is satisfactory, considerable impurity content can be tolerated without seriously degrading P_{fmax}. (auth)

17012 LOSSES OF A THERMONUCLEAR PLASMA IMPLODED BY A HIGH-VELOCITY WALL. Rioux, C.; Jablon, C. (Univ. de Paris-Sud, Orsay, France). Nucl. Fusion; 15: No. 3, 425-429(Jun 1975).

Energy losses occurring in high-temperature plasma in contact with a rapidly moving wall are studied. It is found that thermal-conduction and radiation losses prevent reaching thermonuclear temperatures unless the wall moves at a very high speed. On the other hand, re-absorption in high-density systems and relatively weak magnetic fields reduce these losses. A thermonuclear regime can be reached with wall velocities of 25 km/s, attainable by electromagnetic techniques. (auth)

17013 RELATIVISTIC LIMITATIONS ON RUNAWAY ELECTRONS. Connor, J. W.; Hastie, R. J. (Culham Lab., Abingdon, Eng.). Nucl. Fusion; 15: No. 3, 415-424(Jun 1975).

The nonrelativistic theory of a plasma in an electric field E predicts that there will always be runaway electrons, although their number will be exponentially small for fields less than the Dreicer field E_D. However, when $E/E_D \sim kT/m_ec^2$, the ratio of the electron thermal energy to the rest mass energy, relativistic effects become important. After comparing earlier nonrelativistic calculations, the approach of Kruskal and Bernstein is extended to take account of relativistic effects and also to investigate the influence of impurities. It is found that below the critical electric field $E_R = E_D\,(kT/m_ec^2)$ absolutely no runaways are generated. In addition, the number of runaway electrons produced by electric fields in excess of E_R is calculated and one finds significant modifications to the nonrelativistic estimates when $(E_D/E)^2\,(kT/m_ec^2) > 1$. (auth)

17014 APPROACH TO MHD EQUILIBRIUM OF VARIOUS PLASMA CROSS-SECTIONS. Suzuki, Y. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jap. J. Appl. Phys.; 13: No. 5, 855-862(May 1974).

A simple diffused-boundary model is presented for magneto-hydrodynamic equilibrium in straight plasmas and toroidal plasmas with various plasma cross sections. Many examples of simple analytical solutions are given and the relation between the geometrical factors and plasma parameters is obtained for each example. (auth)

Plasma Production

Refer also to abstract 17066.

17015 (IPPJ-203) THERMONUCLEAR FUSION PLASMA PRODUCED BY LASERS. Yamanaka, C.; Yokoyama, M.; Nakai, S.; Sasaki, T.; Yoshida, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Oct 1974. 9p. INIS. NTIS (US Sales Only) $4.00.

Recently much attention has focused on the laser fusion scheme using high density plasma produced by the implosion. The scientific feasibility experiment on laser fusion has come on a time schedule. But physics of the interaction between laser and plasma, the technique of the high compression and the development of high power lasers are still important problems to be studied for the progress of laser fusion. As for the coupling of laser light and plasma, laser bombarding experiments were conducted on hydrogen and deuterium stick targets using a glass laser system "LETKO-I", energy 50 J in nanosecond pulse, and a double discharge TEA CO_2 laser system, energy 100 J in 100 nanoseconds pulse. The decrease of the reflectivity has appeared at the laser intensity of one order larger than the threshold of the parametric instability. The phase modulation of the scattered light due to modulational instability was found. An isotope effect of Brillouin backscattering from the hydrogen and deuterium plasma has also been observed in the red side part of the SHG light. A preliminary compression experiment was tested using a glass laser system "LETKO-II", energy 250–1000 J in nsec pulse. A hologram was used to check the shock wave in plasma by the SHG light converted from the main laser beam. The development of high power lasers has been promoted, e.g., disc glass lasers, E-beam CO_2 lasers and excimer lasers. (auth)

17016 (SAND-75-0262) LASER FUSION AND ELECTRON BEAM FUSION: PROGRESS REPORT, JULY-DECEMBER, 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1975. Contract AT(29-1)-789. 103p. Dep. NTIS $4.00.

The objectives of the Sandia Laser-Fusion and Electron-Beam-Fusion Programs are (1) to explore and develop applications of high-power lasers and laser fusion phenomena, (2) to perform research and development on advanced lasers for laser fusion, (3) to apply these developments to the simulation of nuclear

weapon effects and other military and civilian applications, (4) to develop and explore the electron-beam fusion concept, (5) to perform theoretical and experimental research on electron beams and their applications, (6) to develop advanced pulse power technology for use in the laser and electron-beam-fusion programs. Highlights of this reporting period are given. (auth)

17017 PRODUCTION OF AN EXTREMELY QUIESCENT PLASMA. Goede, A. P. H. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 55-70 of Ion Beam Plasma Interaction. The Production of a Quiescent Plasma. Goede, A. P. H. Amsterdam; Amsterdam Univ. (16 Apr 1975).

An extremely quiescent magnetized plasma, with a noise level of $< \delta n/n > \simeq 2 \times 10^{-3}$, has been produced with the application of small permanent magnets. The magnets are arranged around the plasma column in a multipole configuration. Together with an axial magnetic field they create an average minimum-B field. The steady-state plasma column produced in this field by an ECR discharge not only proves to be extremely quiescent, but also has a nearly uniform density distribution along the axis; $\Delta n/n\, \Delta z \simeq 2 \times 10^{-3}$ cm^{-1}. Densities up to 10^{11} cm^{-3} are produced in helium at 3.5×10^{-3} torr. The electron temperature is about 10 eV. Detailed measurements are presented on the spatial distribution of this unique magnetic field configuration. (NL)

17018 LASER FUSION: A NEW THERMONUCLEAR CONCEPT. Cooper, R. S. (Los Alamos Scientific Lab., NM). Phys. Teach.; 13: No. 2, 87-92(Feb 1975).

The physical basis of laser fusion is discussed. The requirements for harnessing electrical power from this source are outlined along with the present research status of laser fusion. (MOW)

17019 X-RAY PULSE CALORIMETRY OF LASER-PRODUCED PLASMAS. Violet, C. E.; Petruzzi, J.; McQuaid, J. H.; Boster, T. A.; Richards, L. M.; Mead, S. W.; Saroyan, R. A.; Swain, J. E. (Univ. of California, Livermore). Adv. X-Ray Anal.; 18: 204-212 (1975).

The x-ray energy emitted from laser-produced plasmas was measured under various experimental conditions. Two Nd-glass lasers were used in separate experiments to focus pulsed laser light on planar targets. X-ray fluences were measured with newly developed silicon detector calorimeters. Results for various experimental conditions are reported in terms of the efficiency with which the laser light was converted to x-ray energy by plasma production. (auth)

17020 SELF-PHASE MODULATION OF LASER LIGHT IN A LASER-PRODUCED PLASMA. Yamanaka, C. (Institute of Laser Engineering, Osaka University, Suita, Osaka 565, Japan); Yamanaka, T.; Mizui, J.; Yamaguchi, N. Phys. Rev. A 11: No. 6, 2138-2141 (June 1975).

A spectrum broadening due to the self-phase modulation of laser light was observed in a laser-produced deuterium and hydrogen plasma. Qualitative treatments of the density modulation due to the self-focusing process and the modulational instability are discussed. The theoretical estimation of spectrum broadening agrees fairly well with the experimental results. (auth)

17021 LASER FUSION TARGETS. Solomon, D. E.; Henderson, T. M. (KMS Fusion, Inc., Ann Arbor, MI). J. Phys., D (London); 8: No. 7, L85-L86(11 May 1975).

Small hollow glass shells have been filled with gases by inpermeating the gases through their thin walls. The resulting internal gas pressures have been determined by analyzing the gases released from the rupture of individual shells. Shells have been fabricated which when filled at elevated temperatures have been stored at room temperature and atmospheric pressure for 18 months with no measurable decrease in pressure. (auth)

17022 STUDY OF THE 4,471 A AND 4,922 A LINES IN THE AFTERGLOW OF AN HELIUM PLASMA PRODUCED BY LASER. Baravian, G.; Bretagne, J.; Godart, J.; Sultan, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Plasmas). Z. Phys., B; 20: No. 3, 255-260(Apr 1975).

An experimental investigation of the profiles of the 4,471 A and 4,922 A lines in the afterglow of an high density plasma of helium produced by laser is reported. The measured profiles of these two neutral helium lines and their forbidden components are given at electron densities between 5×10^{16} cm^{-3} and 2×10^{17} cm^{-3} and for electron temperature between 3 and 4 eV. (auth)

Plasma Stability

Refer also to abstracts 16972, 16973, 17066, and 17078.

17023 (JAERI-M-5871) NONLINEAR EFFECT ON THE GROWTH RATE OF INTERNAL m = 1 KINK INSTABILITY. Wakatani, M. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 20p. INIS. NTIS (US Sales Only) $4.00.

The growth rate of internal m = 1 kink instability in a tokamak plasma is modified by the nonlinear excitation of m = 2 mode and m = 0 mode which are stable in the linear stability theory. It is assumed that this nonlinear effect is due to the axisymmetric part of helical perturbation. The saturation amplitude of the instability is estimated to be about $\epsilon^{\frac{1}{2}}a$, where a is the plasma radius and ϵ is a small parameter corresponding to the inverse aspect ratio. (auth)

17024 (MATT-1135) CHRONICLE OF ION-CURRENT INSTABILITIES: OLD AND NEW. Landau, R. W. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract AT(11-1)-3073. 28p. Dep. NTIS $4.50.

For counter-streaming ion currents along a uniform magnetic field, a purely growing instability exists with a growth rate as high as 16 times the ion gyrofrequency. When the streaming ions are only 1 percent of the stationary ions, the growth rate is still 4 times the gyrofrequency, but the real part is near the lower hybrid frequency. These instabilities are in addition to the Drummond-Rosenbluth ion mode. Finite beta effects increase the growth rate and can be important for beta greater than 10^{-4}. In all this, T/sub parallel,+/ equals T/sub parallel,-/ and T/sub perpendicular to/ equals 0. (auth)

17025 (MATT-1142) PARAMETRIC INSTABILITIES AND ANOMALOUS DIFFUSION NEAR THE UPPER-HYBRID FREQUENCY. Chen, L.; Okuda, H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. Contract AT(11-1)-3073. 18p. Dep. NTIS $4.00.

Parametric instabilities and associated anomalous particle diffusions due to a pump oscillating near the upper-hybrid frequency are studied in theory and by numerical simulations for a two-dimensional magnetized plasma. It is shown that, besides the three-wave decay process, the convective-cell mode, a purely damped diffusive mode in the absence of pump, can be parametrically driven to be a purely growing mode. Accompanied with the enhanced fluctuations, anomalous particle diffusion is observed. Theory and simulation results are in good agreement. (auth)

17026 GRAVITATIONAL INSTABILITY OF A ROTATING PLASMA WITH FINITE LARMOR RADIUS AND HALL EFFECTS. Sharma, R. C.; Prakash, K. (Himachal Pradesh Univ., India). Indian J. Phys.; 48: No. 9, 836-840(Sep 1974).

The gravitational instability of an infinite homogeneous self-gravitating and finitely conducting, rotating plasma in the presence of a uniform vertical magnetic field is considered to include finite Larmor radius and Hall effects. The dispersion relation is obtained. It is found that the Jean's criterion of instability remains unaffected even if the effects due to rotation, finite Larmor radius, Hall currents and finite conductivity are included. (auth)

17027 HYDRODYNAMIC STABILITY OF A DENSE PLASMA IN A CORRUGATED MAGNETIC FIELD. Spektor, M. D. Zh. Prikl. Mekh. Tekh. Fiz.; No. 1, 30-40(1975). (In Russian).

A stability criterion is obtained for grooved oscillations that is correct for arbitrary values of $\beta = 8\pi p/B^2$. It is shown that in a sufficiently long system there always exist unstable grooved perturbations with a long wavelength somewhat exceeding the period of the corrugations. The equations of motion are solved for these very dangerous perturbations, and the instability increments are found in an ideal plasma and with the viscosity being taken into account. The viscosity is substantial at large β and can lead to a decrease of increment by a factor of $\sim \sqrt{\beta}$. (SJR)

17028 INSTABILITIES OF FINITE-AMPLITUDE OSCILLATIONS OF A PLASMA IN A MAGNETIC FIELD IN THE PRESENCE OF TRAPPED PARTICLES. Kitsenko, A. B.; Pankratov, I. M.; Stepanov, K. N. (Physical-Technical Inst., Kharkov). Plasma Phys.; 17: No. 3, 173-187(Mar 1975).

A study is made of the instabilities of a plane monochromatic electrostatic wave of finite amplitude in a constant magnetic field due to particles trapped by the electric field of this wave under conditions of Cherenkov resonance or cyclotron resonances: $\omega_0 - k_{0z}v_{0z} \approx n\,\omega_B$ (ω_0 and k_0 are the frequency and wave vector of the driving wave, ω_B is the cyclotron frequency, v_{0z} is the velocity of the trapped particles along the magnetic field, $n = 0, \pm 1, \ldots$). If the particles are trapped near a center on the phase plane with the transverse or longitudinal velocity and the helical phase as co-ordinates in the case $n \neq 0$ or on the phase plane with the longitudinal velocity and the helical phase as co-ordinates in the case n = 0, and if the particles have a small spread with respect to the velocities and helical phase, there arise coherent instabilities excited by all the trapped particles. If the wave vector k of the unstable oscillations is not near k_0, there arises an instability of the two-stream type. If $k \approx k_0$, there arises a parametric

satellite instability. In both cases, the maximal growth rate is $\gamma_{max} \sim (n^1/n_0)^{1/3}\omega_0$, where n^1 is the number of trapped particles in unit volume and n_0 is the density of the plasma. (auth)

17029 STABILITY OF A HIGH-β TOKAMAK TO UNIFORM VERTICAL DISPLACEMENTS. Hass, F. A. (Culham Lab., Abingdon, Eng.). Nucl. Fusion; 15: No. 3, 407-413(Jun 1975).

A simple model of a toroidal, high-β quasi-uniform current model of a tokamak with elliptic cross-section is investigated for stability against uniform vertical displacements. On the basis of asymptotic theory, it is shown that for high-β/toroidal effects to be important β must be of order the equilibrium limit. For a given β and ellipticity the mode can always be stabilized by a conducting wall placed sufficiently close to the plasma. Although the plasma is displaced rigidly the toroidicity leads to both m = 1 and m = 2 harmonics in the perturbed vacuum field. (auth)

17030 POSITIONAL INSTABILITIES IN A SHELL-LESS TOKAMAK. Seki, S.; Momota, H.; Itatani, R. (Kyoto Univ. (Japan). Faculty of Engineering). J. Phys. Soc. Jap.; 36: No. 6, 1667-1673(Jun 1974).

The analysis on the positional stability for a horizontal expansion of a plasma loop is improved and generalized, where a tokamak is treated as a transformer in order to avoid some assumptions with respect to the change of the plasma current. As a result, the dependence of the stability condition on the characteristics of the transformer is clarified. (auth)

17031 TWO-STREAM FLOW IN A THIN PLASMA SLAB. Pashchenko, A.V.; Rutkevich, B.N. Sov. Phys.—Tech. Phys. 19: No. 12, 1538-1540 (June 1975).

A general solution is found for the problem of two-stream hydrodynamic flow in a thin plasma slab in a strong longitudinal magnetic field. The solutions of problems with initial boundary conditions are classified, and the role of a simple wave in the general solution is indicated. The possible use of the simple-wave concept to describe the two-stream instability in a beam-plasma system is discussed. (auth)

17032 INTERACTION OF A HOLLOW ELECTRON BEAM WITH A PLASMA. Zemlyanskii, N.M.; Berezin, A.K.; Fainberg, Ya.B.; Bolotin, L.I.; Krivulya, S.S. Sov. Phys.—Tech. Phys. 19: No. 12, 1547-1548 (June 1975).

An experimental study has been made of the interaction of a high-current electron beam with a plasma in a longitudinal magnetic field. When the plasma density is lower than the beam density instabilities are excited by the Cerenkov effect. (auth)

17033 CURRENT-CONVECTIVE INSTABILITY IN A THREE-COMPONENT PLASMA. Meilikhov, E.Z. Sov. Phys.—Tech. Phys. 19: No. 12, 1610-1611 (June 1975).

The current-convective instability of a three-component plasma in the positive column of a discharge in a magnetic field is investigated using the semiclassical approximation. Properties related to the existence of two instability modes are noted. The calculations agree qualitatively with experiments in $Ne+H_2$ gas mixtures. (auth)

17034 ANOMALOUS RESISTIVITY OF TRANSVERSE PLASMA CURRENT AT ELECTRON-CYCLOTRON HARMONICS. Aref'ev, V.I.; Chernov, A.A. (Moscow Physicotechnical Institute). Sov. Phys.—Tech. Phys. 19: No. 12, 1522-1528 (June 1975).

Microscopic instability of the transverse current at electron-cyclotron harmonics (Bernstein modes) are investigated in a plasma with hot ions $T_i > T_e$. It is shown that the main problem connected with instabilities at cyclotron harmonics, which make a large contribution to the anomalous sensitivity of a plasma, for example in the leading edge of a shock wave, is to explain the nonlinear mechanism that saturates the oscillation energy. For the Bernstein modes a nonlinearity is associated with the electrons. Nonlinear damping is determined from the linear theory by using a collision integral that takes account of the similarity between the usual binary collisions and the collective scattering of electrons by microscopic turbulence. The effective electron-scattering frequencies are found from the stabilization condition for different spectra. It is shown that the collective friction force produced by the instabilities does not always stabilize them; for example, stabilization does not occur for current velocities that significantly exceed the ion thermal velocity. In this case a broad spectrum of current-dissipative instabilities develops, and the collective friction force favors the development of cyclotron instabilities. Some nonlinear mechanisms that stabilize the current-dissipative instabilities are investigated. Typical examples are the development of vortical instabilities in an electron gas and the appearance of anomalous viscosity. (auth)

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Refer also to abstracts 16963, 17064, and 19231.

17035 (BNL-20194) HEAT TRANSFER AND PRESSURE DROP CALCULATIONS: MINIMUM ACTIVATION ALUMINUM BLANKET. Filio, J. (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1975. 51p. Dep. NTIS $5.75.

The design of the fusion reactor cooling system considers the transmission of heat in solid components of the blanket and the transfer of heat from those components to a coolant across the solid-fluid interface. In addition, pressure drop effects are also taken into account. It is seen that it is possible to determine the temperature distribution in various parts of the blanket as well as the coolant streams. Such a knowledge is of importance, for example, since a particular temperature may set a limit on the thermal efficiency or the use of a particular structural material. The work is a documentation of assumptions made and methods used in the "reference" design calculations as well as proposed methods to be used in the "option" designs. The report consists of sections on the water and the He coolant systems--pressure drop and heat transfer effects. A discussion is given of proposed analysis methods for several option designs. The detailed reference design calculations are included. (auth)

17036 (CONF-740807-P2, pp 972-982) TRITIUM RECOVERY AND SEPARATION FROM CTR PLASMA EXHAUSTS AND SECONDARY CONTAINMENT ATMOSPHERES. Forrester, R. C. III; Watson, J. S. (Oak Ridge National Lab., TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard, Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Recent experimental successes have generated increased interest in the development of thermonuclear reactors as power sources for the future. This paper examines tritium containment problems posed by an operating CTR and sets forth some processing schemes currently being evaluated at the Oak Ridge National Laboratory. An appreciation of the CTR tritium management problem can best be realized by recalling that tritium production rates for various fission reactors range from 2×10^4 to 9×10^5 Ci/yr per 1000 MW(e). Present estimates of tritium production in a CTR blanket exceed 10^9 Ci/yr for the same level of power generation, and tritium process systems may handle 10 to 20 times that amount. Tritium's high permeability through most materials of construction at high temperatures makes secondary containment mandatory for most piping. Processing of these containment atmospheres will probably involve conversion of the tritium to a nonpermeating form (T_2O) followed by trapping on conventional beds of desiccant material. In a similar fashion, all purge streams and process fluid vent gases will be subjected to tritium recovery prior to atmospheric release. Two tritium process systems will be required, one to recover tritium produced by breeding in the blanket and another to recover unburned tritium in the plasma exhaust. Plasma exhaust processing will be unconventional since the exhaust gas pressure will lie between 10^{-3} and 10^{-6} torr. Treatment of this gas stream will entail the removal of small quantities of protium and helium from a much larger deuterium-tritium mixture which will be recycled. (auth)

17037 (ERDA-11) FUSION POWER BY MAGNETIC CONFINEMENT. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Controlled Thermonuclear Research). [nd]. 24p. GPO $1.20.

This report graphically explains the principal aspects of fusion. It illustrates how thermal energy is used to generate electricity, how energy can be produced from fusion, how the present research and development program is oriented, and finally how present efforts can lead to commercial fusion power. (auth)

17038 (ERDA-1544) TOKAMAK FUSION TEST REACTOR FACILITIES. Final Environmental Statement. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jul 1975. 510p. Dep. NTIS $10.50.

Detailed descriptions are given of the site, TFTR complex, environmental protection systems, anticipated benefits of the TFTR facility, characterization of the existing environment, and environmental impact of the plant. (MOW)

17039 (ERDA-tr-41) OBTAINING NEGATIVE IONS BY MEANS OF OVERCHARGING A HYDROGEN BEAM ON A SODIUM TARGET. D'yakov, B. A.; Krylov, A. I.; Kuznetsov, V. V.; Maksimenko, B. P.; Semashko, N. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1975. Translation of IAE-2523. 12p. Dep. NTIS $4.00.

A beam of negative ions with a value up to 150 mA, an energy of 5 keV, and a pulse length of 10 mu s was obtained in the experiment. The data were obtained regarding the operation of the ion source in the presence of sodium vapor. No visible traces of

sodium were found on the electrodes of the source. Sodium was present on the flange surrounding the ion-optic system. Possibly, the appearance of the sodium was due to an unstable operating regime of the sodium stream in the period of converting the target to the operating regime. No noticeable decrease in the high voltage stability of the source was observed following operation in the presence of sodium vapor for approximately 20 hours. The value of equilibrium yield of negative ions of F$^-$/sub infinity/ was obtained following the passage of a 5 keV hydrogen beam through a thick sodium target. The equilibrium yield probably could increase by several percentage points as the result of decreasing pressure of the gas in the ion guide 5 between the target and vacuum container. (MOW)

17040 (HEDL-TME-75-56) CONTROLLED THERMONUCLEAR RESEARCH. Quarterly Report, January, February, and March 1975. Doran, D. G.; Yoshikawa, H. H. (Comps.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-2170. 55p. Dep. NTIS $5.45.

The objective of this program is the correlation of irradiation effects produced in reactor and accelerator irradiation facilities for the prediction of materials performance in CTR environments. This includes the definition of the applicability of irradiation test data from other programs to the CTR effort and the implications of the differences between irradiation test environments and CTR environments to the design of CTR materials irradiation testing programs. Four interrelated tasks have been defined for this program: A. correlation of damage data for CTR applications, B. irradiation effects modeling in support of experimental programs, C. damage production modeling in support of experimental programs, and D. helium production file development. Described in this report is progress in determining the effectiveness of available and proposed neutron spectra for deriving damage functions for CTR applications, progress in determining the effect of cyclic operation of a radiation source on the evolution of irradiation-induced changes in microstructure, and a new displacement cross section for tungsten. (auth)

17041 (IS-3634) HYDROGEN EMBRITTLEMENT AND OTHER EFFECTS IN THERMONUCLEAR REACTOR MATERIALS. Scott, T. E. (Ames Lab., Iowa (USA)). Jun 1975. Contract W-7405-eng-82. 73p. (CONF-720515-5). Dep. NTIS $6.75.

From 4th annual spring meeting of the Metallurgical Society of AIME; Boston, Massachusetts, USA (8 May 1972).

Current fusion reactor design concepts are based on deuterium-tritium plasma fuel. The fuel and possible internal proton creation by (n,p) reactions provide sources of hydrogen isotopes which may have serious deleterious effects on the integrity of containment materials in a thermonuclear reactor. This paper considers the potential deleterious effects of hydrogen isotopes on the mechanical behavior of candidate containment materials, such as vanadium, niobium, molybdenum and others. Current knowledge of hydrogen-induced embrittlement in these metals is reviewed in relation to CTR application and other potential material problems caused by hydrogen isotopes under fusion reactor operating conditions are indicated. Related information such as hydrogen solubility, hydrogen-metal phase diagrams, and hydrogen diffusivity are included. (auth)

17042 (JAERI-M-5862) INDUCED ACTIVITY OF THE COPPER COIL IN D-T BURNING EXPERIMENT. Seki, Y; Harada, Y.; Asami, N. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 29p. (In Japanese). INIS. NTIS (US Sales Only) $4.50.

The induced activity and decay heat in the copper coil of a zero-power critical plasma experimental facility when D-T burning is carried out and calculated, and also the irradiation dose therefrom. Details of the critical plasma experimental facility are not known yet, so a fictitious model is assumed. The results obtained thus cannot be directly applied to the facility, but still may be useful. The method developed for calculation of the irradiation dose is usable in the proposed D-T burning experiment facility or a future fusion reactor. (auth)

17043 (JAERI-M-5898) OPTIMUM DESIGN OF OHMIC HEATING FIELD COILS FOR AN AIR-CORE SYSTEM AND EQUILIBRIUM FIELD COILS OF A LARGE SCALE FUSION DEVICE. Kobayashi, T.; Tamura, S.; Tani, K. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 84p. (In Japanese). INIS. NTIS (US Sales Only) $7.25.

Numerical methods are presented for determining optimum configuration of ohmic heating (OH) field coils for an air-core system and equilibrium field coils of a large scale fusion device. In one method, the currents of the prescribed positions are optimized to produce a required magnetic field by a linear programming optimization procedure. The other method is an application of the virtual-casing principle developed by Zakharov and determines simultaneously the currents and their positions of a system of coils. These methods are applied successfully to the determination of the optimum configuration of the OH coils and the equilibrium field coils of a large tokamak currently under design at JAERI. (auth)

17044 (NP-20497) MEASUREMENTS OF POLOIDAL MAGNETIC FIELD PERTURBATIONS IN ALCATOR. de Kock, L. C. J. M.; Meddens, B. J. H.; Ornstein, L. Th. M.; Schram, D. C.; van Heijningen, R. J. J. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica). Oct 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

Poloidal field pick-up coils with a winding density varying as cos mθ or sin mθ are capable of detecting instantaneously modes with azimuthal periodicity m. The construction of a bakeable version of these coils is described. The winding density of these coils varies stepwise as to approximate the cosine or sine functional dependence. Toroidal effects and eccentric position of the plasma column with respect to the coil system are shown to cause signals at coils with other m-number than the instability. A typical example of the use of these coils on Alcator is shown. (auth)

17045 (RD/B/N-3299) FUSION FROM A UTILITY VIEWPOINT. Hall, R. S.; Blow, S.; Clarke, R. H.; Tozer, B. A.; Whittingham, A. C. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1975. 32p. (CONF-7410126-1). Dep. NTIS (US Sales Only) $4.75.

From CEGB research department symposium on long term studies; Berkeley, UK (24 Oct 1974).

A review is presented of the present status and prospects of magnetically and inertially confined fusion systems, with a brief discussion on the combination of fission and fusion in a hybrid system. This is followed by statements on the general fields of materials requirements, safety considerations and economics. (auth)

17046 (UCID-16836) DT FUSION NEUTRON IRRADIATION OF Al NIOBIUM. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jun 1975. Contract W-7405-eng-48. 8p. Dep. NTIS $4.00.

The experimental parameters for irradiating the Atomics International niobium specimen are described. No test results are given. (MOW)

17047 (UCID-16837) DT FUSION NEUTRON IRRADIATION OF BPNL WIRE-FOIL PACKAGE, LLL VANADIUM, LLL NIOBIUM TENSILE SPECIMENS, LLL ALUMINUM TENSILE SPECIMENS, LLL GRAPHITE, UW-LLL METALLIC FOILS, AND SLL FIBER OPTIC BUNDLES. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jun 1975. Contract W-7405-eng-48. 13p. Dep. NTIS $4.00.

The experimental parameters for irradiating the above specimens with 14-MeV neutrons from the LLL Rotating Target Neutron Source are described. No test results are given. (MOW)

17048 (UCRL-51817) PROCEDURE FOR PRODUCING A CYLINDER OF CELLULOSE ACETATE FOAM CONTAINING ONE GLASS MICROSPHERE. Rinde, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 May 1975. Contract W-7405-eng-48. 5p. Dep. NTIS $4.00.

This report, which updates UCRL-51708, describes a procedure for producing foam strands containing a single, well-characterized, DT-filled, glass microsphere. (auth)

17049 CONTROL SYSTEM FOR REGULATING THE SPEED OF DEUTERIUM–TRITIUM TIPPED BULLETS REQUIRED TO IMPLODE UPON ONE ANOTHER TO PRODUCE A CONTROLLED NUCLEAR FUSION REACTION. Pedrick, A. P. British Patent 1,366,285/B/. 11 Sep 1974. Filed Date 9 Jul 1973. 4p.

A speed control system is described for D–T tipped bullets intended to implode on one another to cause initiation of a controlled fusion reaction at about 50 million degrees C. It has been thought that an efficient system for obtaining the required very high temperatures might be obtained by the simultaneous implosion of an odd number of high speed bullets with concave D–T tipped noses, which on implosion enclose a small spherical space into which, just before implosion, strong beams of laser energy are pulsed. The success of this scheme will depend on the accuracy with which a number of bullets can be made to implode on one another on the central axis of a pressure cylinder. It is probable that the explosive force of a number of cartridges of TNT for projection of the bullets cannot be made sufficiently equal to ensure that all the bullets enter the pressure shell at the same velocity. With this in mind an electromagnetic control system is described for regulating the speed of the bullets before they enter the pressure shell. The speed of the bullet is controlled by a

disk spun at high speed by a constant speed electric motor, the arrangement being such that if the bullet moves through some reference distance more rapidly than that determined by the speed of the disk an electric circuit is closed and energizes an electromagnetic coil around the gun barrel so as to create a magnetic field which slows the bullet. (UK).

17050 POWER FROM NUCLEAR FUSION. Maple, J. H. C. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Energy World.; No. 15, 5-9(Apr 1975).

In the present energy climate it seems clear that new sources of energy must be developed. Nuclear fusion power offers the possibility of being a new inherently safe source of energy using cheap readily available fuels and could provide mankind with unlimited power for millions of years. This article gives an elementary description of the basic principles of the fusion process, the current state of the art of the fusion experiments and an outline design of a conceptual reactor. (auth)

17051 MEASUREMENT OF MEGAGAUSS MAGNETIC FIELDS IN A PLASMA FOCUS DEVICE. Peacock, N.J.; Norton, B.A. (United Kingdom Atomic Energy Agency, Culham Laboratory, Abingdon, Berkshire, England). Phys. Rev. A 11: No. 6, 2142-2146 (June 1975).

The magnetic field associated with the dense pinch in a plasma focus device has been measured from the Zeeman splitting of the C V, $2s$-$2p$ emission. Values of the order of 1 MG are derived, in agreement with pressure balance between the self-field due to currents in the pinch and the kinetic pressure of the plasma. (auth)

17052 DISCUSSION [on] A PERSPECTIVE ON FUSION AND FISSION BREEDERS [by] W. HAFELE AND C. STARR. von Hippel, F. (Princeton Univ., NJ); Holdren, J. P. J. Br. Nucl. Energy Soc.; 14: No. 2, 119-122(Apr 1975).

Two independent criticisms are made of the paper by Hafele and Starr (J. Brit. Nucl. Energy Soc., 13: 13-19 (April 1974)), which compares fusion and fission breeder reactors in a discussion of future energy supplies. Both Von Heppel and Holdren discuss several of the issues in the paper which they consider misleading due to flaws or omissions in the arguments put forward. The majority of these are concerned with the authors' treatment of accident hazards. (UK).

17053 LASER-DRIVEN IMPLOSION OF SPHERICAL SHELLS. Brueckner, K. A. (Univ. of California, San Diego, La Jolla); Campbell, P. M.; Grandey, R. A. Nucl. Fusion; 15: No. 3, 471-486(Jun 1975).

The general characteristics of the implosion of glass shells are described and analytic estimates given. The problems of implosion symmetry are enumerated. The results of the analyses are correlated with computer simulation of the implosions. The diagnosis of pellet behavior using X-ray pinhole imaging is described and the characteristics of the implosion signature are given. Comparison with experiment shows that the implosions obtained closely agree with the theoretical and computational predictions. (auth)

17054 TOKAMAK RESEARCH. Furth, H. P. (Princeton Univ., NJ). Contract E(11-1)-3073. Nucl. Fusion; 15: No. 3, 487-534(Jun 1975).

Progress in tokamak research is reviewed for the period 1971-74. The theories of MHD-stability, classical transport and anomalous transport have been refined. The tokamak device population has increased by about an order of magnitude. Non-Ohmic heating methods have been developed successfully. The severity of the problem of plasma impurity has been recognized, and technological countermeasures are being developed. The experimental results on energy confinement are not yet well understood theoretically and cannot be fitted by any simple empirical transport coefficient; the general empirical trend, however, is favorable to the achievement of reactor plasma conditions in large future tokamak devices. (auth)

17055 RIPPLE DIFFUSION AND DECAY OF POLOIDAL ROTATION IN A TOKAMAK PLASMA. Tuda, T. (Japan Atomic Energy Research Inst., Tokai). Nucl. Fusion; 15: No. 3, 541-542(Jun 1975).

The decay of the radial electric field due to toroidal field ripples in tokamak systems in the banana regime was studied. Expressions for the field ripples are given. It is shown that the characteristic decay time for the electric field becomes several tens of milliseconds for typical plasma parameters for next generation tokamaks. (MOW)

17056 CONVERSION OF A BEAM OF NEGATIVE HYDROGEN IONS TO ATOMIC HYDROGEN IN A PLASMA TARGET AT ENERGIES BETWEEN 0.5 AND 1 MeV. Dimov, G. I.; Roslyakov, G. V. (Inst. of Nuclear Physics, Novosibirsk, USSR). Nucl. Fusion; 15: No. 3, 551-553(Jun 1975).

The conversion of H^- ions to H^0 atoms over the 0.5 to 1 MeV range for lithium and magnesium vapor targets was measured. A pulsed beam of H^- ions for a Van de Graaff accelerator passed through a magnetic analyzer and a pair of quadrupole magnetic lenses to reach the measuring chamber. Some data are described. (MOW)

17057 THRESHOLD ENERGIES FOR SPUTTERING. Hotston, E. (Culham Lab., Abingdon, Eng.). Nucl. Fusion; 15: No. 3, 544-547(Jun 1975).

Sputtering information of interest to CTR is discussed and it is shown that a general pattern exists from which the threshold energy of any type of ion incident on a target of any element can be estimated. This generalization also gives an insight into the mechanisms governing sputtering. (MOW)

17058 EFFECTS OF TOROIDAL MAGNETIC FIELD ON AN ANNULAR PLASMA. Kondoh, Y.; Okamura, S. (Gunma Univ., Kiryu (Japan). Faculty of Technology); Nagao, S.; Masuzaki, M. J. Phys. Soc. Jap.; 37: No. 1, 200-205(Jul 1974).

An experimental investigation on some effects of the toroidal magnetic field on an annular plasma produced by a modified hard-core θ-pinch is described. The length of the annular plasma could be varied by a pair of end coils. A high speed camera, a floating double probe and a magnetic probe were used for the investigation. The experimental results show that the toroidal magnetic field has some effects to suppress the macroscopic instabilities, such as the positional instability, and the axial contraction of the annular plasma, where the former was observed in the case with the shorter annular plasma and the latter in the case with the longer one when the toroidal field was not applied. (auth)

17059 METHOD OF MANUFACTURING A MAGNET COIL USED IN A NUCLEAR FUSION APPARATUS. Isobe, S.; Hagiwara, T. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1973-21760/B/. 13 Jun 1969. 5p. (In Japanese).

The present invention relates to method for manufacturing a magnet coil used in nuclear fusion experiments to confine plasma. Magnet coils for such purposes have been manufactured by placing conductor wires in holes provided in the insulating spacers to prevent electric leakage or displacement of conductors by the magnetic force between the electric currents. But it is very difficult to manufacture the magnet by this procedure, since the conductor wires must be wound through many holes in the insulating spacers. In the present method, the conductor coil is cut into a suitable number of parts and several parts of magnet coil are independently manufactured in advance, whereupon the whole magnet is constructed by welding, etc. In the present embodiment, the magnet coil is divided into five parts, each of which are independently completed. By combining these parts, two half magnets are formed, whereupon the whole magnet is accomplished by joining the two halves. (JA)

17060 FORMATION OF A PLASMA FOCUS IN A PLASMA EROSION ACCELERATOR. II. ENERGY CHARACTERISTICS OF THE DENSE PLASMA FOCUS. Kozlov, N.P.; Leskov, L.V.; Protasov, Yu.S.; Khvesyuk, V.I. (N. E. Bauman Moscow Higher Technical School). Sov. Phys.—Tech. Phys. 19: No. 12, 1558-1559 (June 1975).

The integrated characteristics of the plasma focus in erosion plasma accelerators have been determined: the enthalpy and specific heat flux of the focus, the energy and light efficiencies, the utilization factor of the working medium, and the overall energy balance in the system. It is shown that these characteristics can be varied over broad ranges to suit a specific problem. (auth)

17061 EFFECT OF RF IONIZATION ON HALL-CURRENT PLASMA ACCELERATOR. Demidenko, I.I.; Lomino, N.S.; Morozov, A.I.; Padalka, V.G. Sov. Phys.—Tech. Phys. 19: No. 12, 1560-1563 (June 1975).

The effect of auxiliary radio-frequency ionization of the gas near the anode on the properties of a Hall-current plasma accelerator are investigated. Displacement of the region in which the entering gas is ionized toward the anode by the rf fields to an increase in the ion energy in the plasma and to a reduction of the spatial divergence of the plasma jet. (auth)

Wave Phenomena

17062 (RT/FI-(74)49) WALSH SPECTRAL ANALYSIS IN STOCHASTIC REFLECTION BY NONSTATIONARY PLASMA AT MICROWAVES. Cicconi, G.; Rosatelli, C. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Nov 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

A Walsh spectral analysis along with the consequent processing technique, for the cross correlation function, of the stochastic reflection from a nonstationary plasma column in rectangular waveguide is described. Some numerical computation techniques, suitable for simulation, are presented along with a general block diagram of the experimental test set. (auth)

17063 (TRITA-EPP-74-21) ELECTRON PLASMA OSCILLATIONS IN A STATIC ELECTRIC FIELD. Wahlberg, C. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Dec 1974. 60p. Dep. NTIS (US Sales Only) $6.00.

The effect of a static electric field on electron plasma oscillations in a streaming plasma is analyzed theoretically. The plasma is considered to be collisionless, and the time development of an initial perturbation is analyzed in a one-dimensional, linearized, Vlasov-Poisson model. Neglecting the thermal spread of the electrons, an adiabatic invariant is found involving the energy density of the fluctuating electric field and the local values of the electron streaming velocity and plasma frequency. Especially, if the disturbance is due to a small localized perturbation, the total energy in the disturbance divided by the local electron plasma frequency is adiabatically conserved, if the electrostatic potential has a sufficiently slow spatial variation. It is found that disturbances transported in the direction of the static electric field may gain a considerable amount of energy, whereas disturbances transported in the opposite direction are moderately damped. Furthermore, the static electric field introduces a linear phase shift in the fluctuating electric field. If the potential is not of sufficiently slow variation, the effects are in general more complicated, although in some respects the effects are similar to the adiabatic case. (auth)

17064 EXCITATION OF ION CYCLOTRON HARMONIC WAVES BY INJECTION OF A 10 keV ION BEAM INTO A PLASMA. Goede, A. P. H. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 25-54 of Ion Beam Plasma Interaction. The Production of a Quiescent Plasma. Goede, A. P. H. Amsterdam; Amsterdam Univ. (16 Apr 1975).

Presented in this paper are measurements concerning beam–plasma interaction occurring when an energetic ion beam is injected into a plasma. Also discussed is the relevance of these results to a Tokamak neutral beam injection scheme. The excitation of ion cyclotron harmonic waves propagating azimuthally across the applied magnetic field has been observed. The excitation is attributed to the small perpendicular velocity component of the ion beam, independent of the parallel velocity. The experimental results are compared with the linear theory of electrostatic instabilities in a Maxwellian plasma traversed by a monoenergetic beam with dc energy components parallel and perpendicular to the magnetic field. (NL)

17065 PROPAGATION OF MHD SHOCK WAVES INTO REGIONS OF VARIOUS UNIFORM DENSITIES. Chandra, S.; Srivastava, K. M. (Univ. of Jodhpur, India). Nuovo Cim., B; 27B: No. 1, 41-50(11 May 1975).

In the presence of a uniform magnetic field in an infinitely conducting fluid, the pressure behind the MHD shock wave is investigated after the shock wave has interacted with the density variation parallel to the shock front. The case is generalized to another density variation perpendicular to the shock front. The density variation is due to a small discontinuity jump across the interfaces. The problem is formulated under the assumption of small change in density, and the shock profile is obtained. It is observed that the curvature of the shock increases as the Mach number decreases or the strength of the magnetic field increases. (2 figures) (auth)

17066 NONLINEAR EFFECTS IN AN ELECTRON BEAM–PLASMA SYSTEM. van Wakeren, J. H. A. Amsterdam; Amsterdam Univ. (1975). 92p.

Thesis.

The interaction of a 1–2-keV electron beam and a plasma in an axial homogeneous magnetic field is studied by means of an electrostatic energy analyzer. Near the electron gun a wave starts at a small amplitude and grows in space until the beam is trapped in the wave electric field at some fixed distance from the gun and saturation of the wave occurs. The time-averaged measured velocity distribution changes into a plateau type distribution symmetric around the phase velocity of the wave. At greater distance, when the wave has decayed away, a new wave grows until the beam is trapped again; this results in the formation of a new and broader plateau in the distribution function, this plateau is symmetric aound the phase velocity of this wave. In this way, successive energy transfer occurs by successive beam trapping each time resulting in a further broadening of the beam velocity distribution function. Further correlation measurements show that the escond harmonic cyclotron instability follows the plasma instability. Also, the behavior of the amplitude and the phase of the plasma instability as function of time and space has been investigated. From these measurements it becomes clear which electric fields a beam electron meets when it is passing through the plasma column. The phase velocities of the waves differ from the initial beam velocity, so every electron enters the wave at an arbitrary phase of the wave. The beam electrons have to pass several instability regions without mutual phase correlation, which is in favor of the thermalization of the beam. Finally, the attractiveness of using intense relativistic electron beams for ignition of a nuclear fusion reactor is shown. (NL)

17067 ION BEAM PLASMA INTERACTION. Goede, A. P. H. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam). pp 15-24 of Ion Beam Plasma Interaction. The Production of a Quiescent Plasma. Goede, A. P. H. Amsterdam; Amsterdam Univ. (16 Apr 1975).

The differences between ion beam and electron beam plasma systems are discussed. Considering beams of equal density and velocity, it is found that the ion beam plasma system is more stable with respect to the growth of electrostatic waves. When the wave has grown to a sufficiently large amplitude to trap the beam, the energy loss of the beam is larger in the case of an ion beam. In the second part of the chapter are some experimental configurations which might only be realized with serious difficulty when using electron beams. They are specially suited to be carried out with low-velocity ion beams. In this context, the relevant work on ion beam plasma interaction is listed. (NL)

17068 ANOMALOUS DISSIPATION OF THE ENERGY OF ELECTROMAGNETIC WAVES IN A COLLISIONLESS, MAGNETICALLY ACTIVE PLASMA. Batanov, G. M.; Sarksian, K. A. pp 104-147 of Interaction Between Electromagnetic Waves and Plasma. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

The interaction of a SHF pump wave with a collisionless, magnetically active plasma was investigated for plasma frequencies ranging from the Langmuir to the gyroscopic electron frequency, that is, in a range where linear transformation of the waves is not possible. An anomalous dissipation of electromagnetic pump energy was observed, revealing itself in such effects as pump-wave energy absorption, electron heating, and nonthermal plasma emission. These effects are connected with the excitement of parametric instabilities in the magnetically active plasma with the building up of high-frequency and low-frequency plasma oscillations. (IAA)

17069 CYLINDRICAL WAVE PROPAGATION IN A SELF-GRAVITATING COLLISIONLESS PLASMA WITH INITIAL FLUID VELOCITY IN THE PRESENCE OF MAGNETIC FIELD. Chhajlani, R. K. Indian J. Pure Appl. Math.; 4: No. 11-12, 879-888 (1973).

The system of equations derived by Chew et al. (1956) is considered for the wave propagation in self gravitating collisionless plasma in the presence of a magnetic field. The equations are linearized and then converted into cylindrical coordinates. The dispersion relation for the collisionless self-gravitating magnetized plasma with initial fluid velocity was obtained and the effects of gravitational attraction and initial fluid velocity are discussed. It was found that there are three modes of wave propagation subject to certain conditions. (auth)

17070 SLOW MOTIONS OF A VERY RAREFIED PLASMA EXPOSED TO A MAGNETIC FIELD AND TO SELF-GRAVITATION. Agostinelli, C. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.; 55: No. 6, 697-704(Dec 1973). (In Italian).

Some slow magnetohydrodynamic motions are considered for a very rarefied plasma subjected to gravitational and magnetic fields. The case in which the plasma density varies for indefinite plane parallel layers, or by cylindrical coaxial layers is considered. (auth)

17071 SURFACE WAVE PROPAGATION ALONG A CURRENT-CARRYING WARM PLASMA COLUMN. Shivarova, A.; Stoychev, T.; Tusseva, S. (Univ. of Sofia). J. Phys., D (London); 8: No. 4, 383-393(11 Mar 1975).

The propagation of high-frequency surface waves along a plasma column was investigated theoretically and experimentally. From the equations of the one-fluid hydrodynamics, expressions were obtained in a quasistatic approximation for the dispersion of axially symmetric and dipole modes of high-frequency surface waves, propagating along a current-carrying warm plasma surrounded by a dielectric and a vacuum. The detailed experimental investigations of the dispersion and the space damping rate of the surface waves in a neon gas discharge plasma, realized on the basis of the phase shift measurement of the applied and accepted signals and by using a time-space diagram method, was effected at different discharge

currents and gas pressures in a wide frequency range and showed very good agreement with the theoretical results. (auth)

17072 EXPERIMENTAL INVESTIGATIONS OF THE QUASI-POTENTIAL INTERACTION OF NONUNIFORM SHF FIELDS WITH A PLASMA AND CONDITIONS FOR ITS REALIZATION. Sergeichev, K. F.; Gekker, I. R. pp 3-36 of Eksperimental'nye issledovaniia kvazipotentsial'nogo vzaimodeistviia neodnorodnykh SVCh-polei s plazmoi i usloviia ego sushchestvovaniia. Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The present work surveys the results of recent experimental studies on the interaction of a rarefied plasma with strong SHF fields, in which it was shown that the observed phenomena of expansion, reflection, acceleration, and focusing of a plasma are determined by the quasi-potential forces of a nonuniform SHF field. In experiments on the reflection of a plasma current from a SHF barrier, it has been shown that there is a quantitative relationship between the lower limit of the energy spectrum of the plasma crossing a one-dimensional SHF barrier and the height of the barrier. A correlation has been obtained between the measured concentration profile of a focused plasma current and the concentration distribution predicted by the theory of quasi-potential forces. A satisfactory correspondence has been observed between the calculation and observation of the vibrational motion of a plasma current in a quasi-potential well. (IAA)

17073 NONLINEAR PENETRATION OF A STRONG SHF FIELD INTO A LAYER OF A DENSE, COLLISIONLESS PLASMA. Batanov, G. M.; Silin, V. A. pp 87-103 of Nelineinoe proniknovenie sil'nogo SVCh-polia v sloi plotnoi besstolknovitel'noi plazmy. Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The interaction of SHF radiation in the 10-centimeter range with a layer of a dense, collisionless plasma was experimentally investigated. Rapid irradiation of a layer of a supercritical plasma was observed. Measurements of changes in the radial structure of the SHF field distribution in the plasma were made along with measurements of electron concentration and temperature. Measurements of plasma parameters and spectra of radiation penetrating the plasma permit the interpretation of the anomalous plasma transmissivity as an effect connected with the creation of a parametric decay instability, leading to the thermal self-interaction of the wave as a consequence of the increased effective frequency of electron collisions. (IAA).

17074 INTERACTION BETWEEN ELECTROMAGNETIC WAVES AND PLASMA. Skobel'tsyn, D. V. (ed.). (Inst. of Physics, Moscow). Tr. Fiz. Inst., Akad. Nauk SSSR; 73: 1-152 (1974). (In Russian).

Four papers are presented surveying some recent experimental results on the nonlinear interaction of intense SHF electromagnetic waves with a collisionless plasma. The topics covered include the quasi-potential interaction of nonuniform SHF fields with a rarefied plasma, including the expansion, reflection, acceleration, and focusing of the plasma; the anomalous absorption of electromagnetic waves with heating of a collisionless, nonmagnetized plasma; the nonlinear penetration of a strong SHF field into a dense, collisionless plasma; and the anomalous dissipation of the energy of an electromagnetic pump wave in a magnetically active plasma. (IAA)

17075 DIFFERENTIAL COEFFICIENT OF INCOHERENT REFLECTION FROM COLLISIONLESS PLASMA. Genchev, Z. D. (Inst. of Electronics, Sofia). Bulg. J. Phys.; 1: No. 1, 79-86 (1974).

A theoretical consideration of hf electromagnetic field scattering in an isotropic plasma half-space with specular reflection of particles from a plasma boundary is presented. The differential coefficient of reflection due to incoherent scattering by longitudinal and surface fluctuational waves is calculated. (auth)

17076 COLLISIONAL DAMPING OF LANGMUIR WAVES IN ONE-DIMENSIONAL PLASMA SIMULATIONS. Godfrey, B. B.; Newberger, B. S. (Los Alamos Scientific Lab., NM). Plasma Phys.; 17: No. 5, 317-326(May 1975).

The collisional damping of long wavelength Langmuir waves in a one-dimensional particle code plasma simulation is investigated in detail. In particular, it is shown that this damping varies as $(n\,\lambda_D)^{-1}$, is generally independent of wave number, and most importantly, can be reduced significantly by judicious suppression of short wave-length ion fluctuations. All these results prove to be in good quantitative agreement with classical inverse bremsstrahlung theory, if appropriately modified to one dimension. Additionally, simulations showing anomalously large decay rates for thermal Langmuir wave auto-correlation functions are presented. The cause of this behavior is not entirely clear. Finally, the equilibration rate for ion fluctuations is touched upon. (auth)

17077 NON-LINEAR ION-ACOUSTIC OSCILLATIONS OF A NON-ISOTHERMAL CURRENT CARRYING PLASMA CLOSE TO THE INSTABILITY THRESHOLD. Abu-asali, E.; Al'Terkop, B. A.; Rukhadze, A. A. (Lebedev Physical Inst., Moscow). Plasma Phys.; 17: No. 3, 189-212(Mar 1975).

The nonlinear stage of development of ion acoustic oscillations of a nonisothermal plasma excited by a current is investigated just above threshold. The time evolution of the amplitudes of the linearly unstable volume and surface waves are studied up to the saturation stage. It is shown that the mechanisms restricting amplitude growth are the frequency shift and the nonlinear damping due to the production of higher harmonics of the excited waves. The investigation is carried out both for weakly collisional plasma, in which the growth of oscillations is due to the electron Cherenkov effect, and for the case of frequent collisions, when the cause of the instability is the inverse conductivity and electron diffusion in the current-carrying plasma. (auth)

17078 LINEAR WAVES AND INSTABILITIES. Bers, A. (Massachusetts Inst. of Tech., Cambridge). Contract AT(11-1)-3070. pp 113-215 of Plasma Physics--les Houches 1972. New York; Gordon and Breach Science Publishers (1975).

The electrodynamic equations for small-amplitude waves and their dispersion relation in a homogeneous plasma are outlined. For such waves, energy and momentum, and their flow and transformation, are described. Perturbation theory of waves is treated and applied to linear coupling of waves, and the resulting instabilities from such interactions between active and passive waves. Linear stability analysis in time and space is described where the time-asymptotic, time–space Green's function for an arbitrary dispersion relation is developed. The perturbation theory of waves is applied to nonlinear coupling, with particular emphasis on pump-driven interactions of waves. Details of the time–space evolution of instabilities due to coupling are given. (MOW)

17079 ELECTROSTATIC WAVES NEAR THE LOWER HYBRID FREQUENCY. Stenzel, R.L.; Gekelman, W. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. A 11: No. 6, 2057-2060 (June 1975).

The propagation of slow electrostatic waves across a magnetic field $\vec{B}_0$ ($k_\parallel^2 / k_\perp^2 \lesssim m_e/m_i$) near the lower hybrid frequency ($\omega \lesssim \omega_{LH}$) has been investigated experimentally in a large uniform magnetoplasma. The dispersion is in good agreement with the fluid description; warm-plasma effects appear near $k_\perp r_{ci} \simeq 2\pi$. Propagation of wave packets reveals the dispersive and backward wave nature of the modes ($v_{g\perp} > 0$, $v_{g\parallel} \lesssim 0$, $v_{g\perp} \ll |v_{g\parallel}|$), the different directions of phase and group velocity ($\omega/k \sim 1 \gg \omega/\partial k \sim \|\vec{B}_0$) and the cone structure of the antenna radiation pattern. (auth)

17080 COHERENT SCATTERING BY AN INHOMOGENEOUS PLASMA COLUMN. Stanic, B. V. (Belgrade Univ.). J. Phys., A (London); 8: No. 5, 816-828(May 1975).

The microwave power scattered by a circular cylinder of inhomogeneous plasma contained in a glass tube is computed with the aid of the Frobenius method. It is found that computed and experimental values are in good agreement in the range $0.2 < \lambda/R < 3.0$. Values are also computed for wavelengths of 8 mm and 3 cm for a range of collision frequencies with the electric vector parallel or perpendicular to the cylinder axis. (auth)

17081 WAVE PROPAGATION THROUGH NONUNIFORM PLASMA. Paul, S. N.; Bondyopadhaya, R. (Jadavpur Univ., Calcutta). Indian J. Phys.; 48: No. 11, 987-1001(Nov 1974).

The dispersion relation for the waves which propagate through a nonuniform plasma was deduced. The purpose of this study was to find the effect of density gradients on wave propagation. It was found that the density gradient may give rise to instability of longitudinal and transverse waves, provided the stream (or thermal) velocity is present. The dependence of the instability factor on the density gradient was discussed in some detail. The instabilities of the waves (longitudinal and transverse) due to density gradient were found to be significant in the rarified medium having large density gradient. Some hints of the possible applications to the present analysis are also discussed. (auth)

17082 EFFECT OF MISMATCH ON STIMULATED SCATTERING IN LASER-PLASMA INTERACTIONS. Anderson, D.; Wilhelmsson, H. (Chalmers Univ. of Tech., Goteborg). Nucl. Fusion; 15: No. 3, 387-392(Jun 1975).

The influence of mismatch on a coherent, stimulated process including the effect of pump depletion is studied. The efficiency of the nonlinear three-wave interaction exhibits marked threshold behavior for increasing mismatch, a result which is a generalization of the corresponding behavior of parametric processes. The analysis is applied to the stimulated scattering processes (notably stimulated Brillouin scattering) occurring in laser-plasma interactions, where severe mismatch may be caused by plasma in-

homogeneity and/or differential Doppler shifts. By means of a simple physical model one obtains thresholds for stimulated scattering in inhomogeneous and differentially expanding plasmas, results which are in good agreement with those recently given by an alternative approach. In addition, expressions predicting the rise of the reflectivity above threshold are given. (auth)

17083 ROTATION OF POYNTING VECTOR FOR ULTRALOW-FREQUENCY ION WAVES IN AN INHOMOGENEOUS PLASMA. Al'pert, Ya.L.; Kaufman, R.N. (Institute of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation, Academy of Sciences of the USSR). Sov. Phys.—Tech. Phys. 19: No. 12, 1519-1521 (June 1975).

A theoretical study is made of the region in which the Poynting vector S of ultralow-frequency ion waves incident upon the planar boundary (xy plane) of a magnetoactive inhomogeneous plasma turns is rotated in the direction of the static magnetic field H_0. The frequency of the investigated waves varies in the range $0 < \omega \leqslant \omega_L$ (ω_L is the lower hybrid frequency). The solution is found in the quasilongitudinal approximation. The Poynting vector S is shown to turn rapidly at the plasma surface, the angle ψ between S and H_0 reaching the limiting value $\psi\infty$ ($z\to\infty$) at distances (z) of 20–30 km from the boundary. The dependence of $\psi\infty$ on frequency is investigated allowing for the collision frequency ν. (auth)

17084 TRANSFORMATION OF NONLINEAR MHD WAVES. Zaslavskii, G.M.; Moiseev, S.S.; Mukhin, V.V. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.—Tech. Phys. 19: No. 12, 1534-1537 (June 1975).

The transformation of a slow nonlinear acoustic wave into a fast acoustic wave in a slightly inhomogeneous plasma is analyzed. The transformation coefficient is calculated for the case in which the nonlinearity can be assumed slight. (auth)

17085 PARAMETRIC EXCITATION OF HELICON WAVES IN A PLASMA BY MODULATED RADIO FREQUENCY WAVES. Paverman, V.S.; Tskhakya, D.D. (Institute of Physics, Academy of Sciences of the Georgian SSR, Tbilisi). Sov. Phys.—Tech. Phys. 19: No. 12, 1629-1630 (June 1975).

The excitation of helicon waves is studied in a magnetoactive plasma in an external weakly modulated high-frequency electric field. The characteristic frequencies of such a system are shown to depend on the amplitude of the external field. Parametric resonance phenomena appear at certain modulation frequencies and the characteristic helicon waves are excited. The growth rate and the threshold amplitude of the external field are determined. (auth)

17086 SPATIAL COLLAPSE OF BEAM-DRIVEN PLASMA WAVES. Wong, A.Y.; Quon, B.H. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 34: No. 24, 1499-1502 (16 June 1975).

Electron-plasma waves driven unstable by an electron beam are observed to be backscattered by stationary density perturbations to form standing waves. Above a certain threshold these standing waves develop into sharply localized ($\sim 10\lambda_D$) intense fields, $E_{max}^2/4\pi n_0 kT_e \simeq 1$. Significant fractions of beam electrons are scattered in velocity space by these stationary spikes of high-frequency field. (auth)

ENGINEERING

Energy Conversion

17087 (COO-2155-16) BIOMEDICAL ENGINEERING SUPPORT. Third Quarterly Progress Report, February 16, 1975–May 15, 1975. Kolff, W. J.; Smith, L. M.; Sandquist, G. M. (Utah Univ., Salt Lake City (USA)). 1975. Contract E(11-1)-2155. 7p. Dep. NTIS $4.00.

An implantation experiment was conducted to continue development of surgical procedures as well as to assess the overall performance and adequacy of the PuO_2 radioisotope-powered ERDA blood pump. This experiment was directed primarily at determining and evaluating the pump and ventricular efficiency, improving surgical procedures and evaluating the application of a stainless strap encompassing the ventricles to prevent possible interference during pumping from surrounding tissue and organs. The experiment was scheduled as a long-term experiment in a 110 kg male Holstein calf. The electric motor was implanted in the abdomen which powered ERDA blood pump No. 2 via a $\frac{3}{16}$" flexible drive shaft. During the experiment, after implantation of the ERDA Artificial Heart System and initial operation, and just as the calf was being taken off heart-lung bypass, the implanted electric motor stopped operating. In spite of efforts to reinstate operation, the electric motor continued to operate sporadically. Subsequent analysis of the motor after termination of the experiment revealed moisture and corrosion products which were sporadically short circuiting the motor. (TFD)

17088 (INSD-2650-26(Add.)) TAGS-85/2N ISOTOPE POWER SUPPLY. Jupiter/Pioneer Addendum. (Isotopes, Inc., Middle River, Md. (USA). Nuclear Systems Div.). Jul 1969. 301p. Dep. NTIS $18.25.

Declassified 21 Jun 1972.

The design, operation, and safety characteristics of TAGS-85/2N RTG power system for the NASA Jupiter Pioneer Spacecraft are summarized. (TFD)

17089 (WANL-TME-2682) STATIC TEST DATA SUMMARY, TUBULAR MODULE TEM-9U S/N-17. Bailey, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1970. 16p. Dep NTIS $4.00.

TEM-9U S/N-17 is a standard tubular module identical in design to those developed under the Compact Converter Program. Built as part of the Compact Thermoelectric Converter System Technology Program, TEM-9U S/N-17 was subjected to initial testing at WANL for 112 hours. During the heatup and cooldown phases, temperature mapping experiments were carried out to determine the module performance at various specified average clad temperature combinations. The results of the qualification static testing at WANL will be compared with test data measured at Marshall Spaceflight Center, Huntsville, Alabama, using a WANL provided test stand. Heatup data from this module are also presented and a comparison of the actual measured performance data is made with the corresponding predicted values. (auth)

17090 IMPLANTABLE NERVE STIMULATOR. (to Acro Nuclear Co.). Netherlands Patent 7,312,497/A/. 11 Sep 1974. 8p. (In Dutch).

This instrument is an analogue of the cardiac pacemaker, although an important technical innovation is implemented on it. A radioisotope thermopile is coupled with a voltage amplifier and a stabilizer. A pulse chain generator provides signals each consisting of a monitored chain of dc pulses followed by an interval. The duration of the interval exceeds the duration of the signal by 24%. The amplitude is modulated into a saw tooth pattern whereby an exact simulation of a natural neurological signal is effectuated. The nuclear battery contains plutonium-238 and weighs about 92 g with a size of $1\frac{1}{2}$ in. dia × $1\frac{1}{16}$ in. thickness. The instrument is contained in a cylindrical sealed titanium tube which is implanted on the diaphragm to stimulate one or both of the nervi phrenici. (NL)

Facilities and Equipment

17091 (BMI-1933) RECTANGULAR-DCB SPECIMENS FOR FAST FRACTURE AND CRACK ARREST MEASUREMENTS. Hoagland, R. G.; Kanninen, M. F.; Rosenfield, A. R.; Hahn, G. T. (Battelle Columbus Labs., Ohio (USA)). Dec 1974. Contract W-7405-eng-92. 93p. Dep. NTIS $5.45.

Guidelines are presented for the design, instrumentation, and analysis of rectangular-DCB (double-cantilever-beam) specimens for measuring fast fracture and crack arrest. The theoretical and experimental work from which the guidelines are drawn is described, and some calculations of crack propagation and arrest for hypothetical stress intensity parameters and crack velocities are presented. (HDR)

17092 (NP-20502) DESIGN OF AN EVAPORATION SYSTEM FOR A URANYL NITRATE SOLUTION. Romero, R. J. M. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Quimica). 1975. 99p. (In Spanish). Dep. NTIS (US Sales Only) $8.00.

Thesis.

A brief description is given of the fabrication process of nuclear fuel elements beginning with the processing of the crude ore. The design of an evaporation system for a uranium refining plant, including details on the mechanical design of the equipment and its installation, is then described in detail. The specifications which such a system must meet are analyzed with a consideration of material and energy balance, selection of construction materials, and costs. (JSR)

17093 (ORNL-SUB-3193-2) FINITE ELEMENT ANALYSIS OF ELASTO-PLASTIC TEE JOINTS. Powell, G. H. (California Univ., Berkeley (USA). Coll. of Engineering). Sep 1974. 107p. Dep. NTIS $8.50.

The theory and computational procedures used in the computer program B169TJ/EP for the analysis of elasto-plastic tee joints are described, and detailed user's guide is presented. The program is particularly applicable to joints conforming to the ANSI B16.9 Manufacturing Standard, but can also be applied to other joint geometries. The joint may be loaded by internal pressure and by arbitrary combinations of applied forces and moments at the ends of the branch and run pipes, and the loading sequence may be arbitrary. The joint material is assumed to yield according to the von Mises criterion, and to exhibit either linear kinematic hardening or nonlinear isotropic hardening after yield. The program makes use of the finite element and mesh generation procedures previously applied in the elastic stress analysis program B16.9TJ/SA, with minor modifications. (auth)

17094 SYSTEM FOR MEASURING THE STRESS IN A STRUCTURE USING X-RAY. Takano, H.; Tsutsui, H.; Kibune, M.; Miyoshi, K. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1973-26314/B/. 27 Mar 1968. 4p. (In Japanese).

The present invention relates to a system for measuring the stress in a structure constructed with steel or cast iron. The system comprises an x-ray source for radiating x-rays, a detector for detecting the scattered beam, a drive mechanism for scanning the detector, and a convertor for converting the angle of the detector into an electrical signal. The spectrum of the scattered beam is detected by scanning the detector so that it is plotted on an x-y recorder. The counting rate representative of the diffraction strength of the x-ray and the value of sin 2θ are indicated along the ordinate axis. The diffraction angle of the x-ray is indicated along the abscissa. Ψ is the angle between the perpendicular line to the surface of the specimen and the bisector between the incident x-ray beam and the maximum diffraction direction, and $2\theta_\Psi$ is the angle of maximum diffraction. The measurements are repeated at different incident angles plotting a plurality of spectrums. The stress X is obtained from the formula $X = k[\partial(2\theta_\Psi)/\partial(\sin^2\Psi)]$. (JA)

Lasers

17095 (COO-2007-63) ADVANCED COUPLING OF NUCLEAR REACTOR-GAS LASER SYSTEMS. Technical Progress Report, August 31, 1974–August 31, 1975. Verdeyen, J. T.; Miley, G. H.; Wells, W. E. (Illinois Univ., Urbana (USA)). 1975. Contract AT(11-1)-2007. 50p. Dep. NTIS $5.50.

Research progress on the development of direct nuclear pumped (DNP) lasers is reported. Most of the work was on a Ne–N_2 DNP laser. Some work is reported on He–Ne–O_2, He–Hg, and the chemical lasers BF_3–CH_4 and SF_6–CH_4. (TFD)

17096 (UCID-16843) CALCULATED EFFECT OF DEAD ZONE LOCATION ON THERMAL BLOOMING OF A HIGH POWER LASER. Fleck, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jul 1975. Contract W-7405-Eng-48. 32p. Dep. NTIS $4.25.

It is now well known that the propagation of high power laser radiation through absorbing unionized gases is adversely affected by transverse gradients of the dielectric constant arising from

changes of gas density. The radiation can be severely defocussed by the presence of hot gas within the beam, where the density is depressed below the ambient value, and the consequent effect on the radiation pattern is referred to as thermal blooming. The change of dielectric constant is associated principally with changes of gas density rather than with changes of the temperature. Thermal blooming may be substantially altered if the gaseous medium is in a state of turbulence or if there is directed flow of the gas. These possibilities are taken into account in a study of the propagation of pulsed and steady beams in progress at the Livermore Laboratory. An interesting comparison between propagation characteristics of a steady beam with and without gas flow directed normally to the direction of propagation is presented. It is generally true that transverse flow reduces the amount of thermal blooming, and the central question is where along the path of propagation does an interval of zero transverse flow (known as a dead zone) produce the maximum thermal blooming as indicated by the radiation pattern at the focal plane. (TFD)

17097 (UCID-16847) METHOD FOR GENERATING COHERENT 14 AND 16 mu RADIATION IN CO_2. Krupke, W. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Jul 1975. Contract W-7405-Eng-48. 10p. Dep. NTIS $4.00.

A mechanism is proposed for producing coherent radiation in CO_2 vibrational-rotational transitions at wavelengths near 14 and 16 microns. A device configuration for its implementation is given. (TFD)

17098 (UCRL-75382) X-RAY AND gamma-RAY LASER STUDIES AT THE LAWRENCE LIVERMORE LAB. Wood, L.; Chapline, G.; Slutz, S.; Nuckolls, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Apr 1975. 21p. (CONF-7404110-1). Dep. NTIS $4.25.

From annual meeting of the Optical Society of America; Washington, District of Columbia, USA (25 Apr 1974).

A review of LLL work on x-ray and gamma-ray lasers is presented. Three possibilities for laser action at lambda less than 100 A that have been identified are discussed. (TFD)

17099 (UCRL-76353) FREE STREAM JET FOR HIGH POWER DYE LASERS. Foley, R. J.; Kuklo, T. C.; Peterson, O. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 May 1975. 13p. (CONF-750520-7). Dep. NTIS $4.00.

From IEEE Optical Society of American conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

Tunable dye lasers with powers on the order of many tens of watts to several kW with emission linewidth stability on the order of 1/2 GHz will be required for commercial scale separation processes. To achieve these goals, several dye laser systems, both cw and pulsed, are presently under investigation at Livermore and other laboratories. Results of efforts to develop a free stream dye jet for incorporation into an incoherently pumped pulsed dye laser are presented. (TFD)

17100 PATHS OF RESEARCH TOWARD X-RAY LASERS. Carillon, A.; Jaegle, P.; Jamelot, G.; Sureau, A. (Univ., Orsay, France). Onde Electr.; 54: 441-445(Nov 1974). (In French).

The investigations on the x-ray laser are attaining an experimental stage. The issue depends on the generation of population inversion between atomic or ionic levels of convenient energy. With regard to the active medium two different possibilities are considered. Neutral atoms in solid or vapor state can be pumped by x-ray photoionization. This requires a high pumping power which shall be achieved in the near future in using the x-ray conversion of the beam energy of a Nd-glass laser. On the other hand, population inversions seem possible in hot dense plasmas of highly charged ions. The dense free electron gas surrounding the ions makes a reserve of charges able to populate preferentially some ionic levels in the course of the plasma life when unbalanced situations occur. Experimental results are presented for the aluminum ions in a laser produced plasma. (IAA)

17101 EFFECT OF ADDING CHLOROFORM AND ETHER IN SMALL QUANTITIES ON ELECTRON ENERGY DISTRIBUTION IN CO_2 LASER PLASMA. Stefanov, V. I.; Atanasov, P. A.; Gelev, Ch. G. (Inst. of Electronics, Sofia). Bulg. J. Phys.; 1: No. 1, 87-92(1974). (In Russian).

Using the method of second derivative of a probe current with respect to the voltage, the effect of adding small quantities of chloroform and diethylether (10^{-3} to 10^{-2} torr) on the electron energy distribution in a conventional CO_2 laser was investigated. It was found that the energy distribution function narrows itself and its maximum shifts to the lower energies. The number of electrons with energies 0.5 to 2.5 eV increases at the expense of the electrons with energies 3 to 8 eV, i.e., the mean electron energy decreases. The increase of the output power of cw CO_2 laser by adding organic admixtures, that was resently observed, is most probably due to the resonance transfer of vibrational energy from the lower laser level 10^00 (C_3O) to the very near vibrational levels of the admixtures and, or the exchange of mean electron energy. The latter causes increase in excitation rate of upper laser level of $CO_2(00^01)$. (auth)

17102 GAIN SWITCHING AND *Q* SPOILING OF IODINE LASER WITH A SHOCK WAVE. Ishii, S.; Ahlborn, B.; Curzon, F.L. (Department of Physics, University of British Columbia, Vancouver, British Columbia, V6T 1W5, Canada). Appl. Phys. Lett. 27: No. 3, 118-119 (1 Aug 1975).

The power output of an iodine laser has been increased and the half-width of the laser spike reduced by compressing the photolytically pumped laser gas with a shock wave. The deflection of the beam in the density gradient of the shock front *Q* spoils the laser cavity until the shock front has traversed the lasing volume. (auth)

17103 SCALING OF THE HELIUM-NITROGEN CHARGE TRANSFER LASER. Collins, C.B.; Cunningham, A.J. (The University of Texas at Dallas, Box 688, Richardson, Texas 75080). Appl. Phys. Lett. 27: No. 3, 127-128 (1 Aug 1975).

The scaling to high powers of the nitrogen ion laser pumped by charge transfer from He^+_2 is reported. Intense emission has been found from three laser lines at 3914, 4278, and 4709 Å upon discharge of a fast-pulsed electron beam gun, APEX-1, into several atmospheres of a mixture of helium and nitrogen. Excitation current densities were 1.3 kA/cm² at 1 MV over a 1×10-cm transverse geometry. The efficiency of the 4278-Å laser emission was found to be proportional to the total pressure raised to the 1.2 power. Outputs of 36 mJ have been obtained from the 1o-cm³ working volume at 30-atm pressure and a peak efficiency of 1.6% relative to the energy lost by the electron beam in this radiating volume has been achieved. (auth)

17104 CONTINUOUS OPERATION OVER 10 000 h OF GaAs/GaAlAs DOUBLE-HETEROSTRUCTURE LASER WITHOUT LATTICE MISMATCH COMPENSATION. Kan, H.; Namizaki, H.; Ishii, M.; Ito, A. (Mitsubishi Electric Corporation, Itami, Hyogo, Japan). Appl. Phys. Lett. 27: No. 3, 138-139 (1 Aug 1975).

By improving the crystal growth conditions, continuous operation over 10 000 h has been achieved with a conventional metallic stripe geometry double-heterostructure laser without using additional Al to the GaAs active region or P to the adjacent GaAlAs layers, and this laser is still being operated. (auth)

17105 ROOM-TEMPERATURE OPERATION OF LOW-THRESHOLD SEPARATE-CONFINEMENT HETEROSTRUCTURE INJECTION LASER WITH DISTRIBUTED FEEDBACK. Casey, H.C. Jr.; Somekh, S.; Ilegems, M. (Bell Laboratories, Murray Hill, New Jersey 07974). Appl. Phys. Lett. 27: No. 3, 142-144 (1 Aug 1975).

Separate-confinement heterostructure injection lasers with periodic corrugations in the optical cavity were prepared by a hybrid liquid phase epitaxy (LPE) and molecular beam epitaxy (MBE) growth process. The *N*-$Al_{0.3}Ga_{0.7}As$, *N*-$Al_{0.12}Ga_{0.88}As$, *p*-GaAs active layer, and *P*-$Al_{0.12}Ga_{0.88}As$ layers were grown by LPE, a 0.3748-μm periodic corrugation was ion milled into the *P*-$Al_{0.12}Ga_{0.88}As$ layer, and then the *P*-$Al_{0.3}Ga_{0.7}As$ and *p*-GaAs top layers were grown over the corrugation by MBE. The temperature dependence of the lasing wavelength between 12.6 and 24.8 °C demonstrated the behavior expected for a distributed-feedback laser. The threshold current density was 2.2 kA/cm² at room temperature. (auth)

17106 GaAs-GaAlAs DISTRIBUTED-FEEDBACK DIODE LASERS WITH SEPARATE OPTICAL AND CARRIER CONFINEMENT. Aiki, K.; Nakamura, M.; Umeda, J. (Central Research Laboratory, Hitachi, Ltd., Kokubunji, Tokyo, Japan); Yariv, A.; Katzir, A.; Yen, H.W. Appl. Phys. Lett. 27: No. 3, 145-146 (1 Aug 1975).

Remarkable reduction of the threshold current density is achieved in GaAs-GaAlAs distributed-feedback diode lasers by adopting a separate-confinement heterostructure. The diodes are lased successfully at temperatures up to 340 °K under pulsed operation. The lowest threshold current density is 3 kA/cm² at 300 °K. (auth)

17107 CONCERNING ONE POSSIBILITY OF LASING IN THE GAMMA BAND. Baklanov, E.V.; Chebotaev, V.P. (Institute of Semiconductor Physics, Siberian Division, USSR Academy of Sciences). JETP Lett. 21: No. 5, 131-132 (5 Mar 1975).

The possibility of developing a γ-ray laser based on stimulated Raman scattering in nuclear transitions is discussed. The appropriate energy-level transitions are considered as well as the incident radiation power necessary to obtain generation. (AIP)

17108 MISALIGNED OPTICAL RING RESONATOR WITH A GAUSSIAN DIAPHRAGM. Boitsov, V. F.; Guseva, T. V. Opt. Spectrosc.; 38: No. 1, 78-79(Jan 1975).

Translated from Opt. Spectrosk.; 38: No. 1, 141-144(Jan 1975).

An optical ring resonator formed by three plane mirrors and a diaphragm whose transmission coefficient obeys the Gaussian

law is considered. The apertures of the mirrors are assumed to be infinite, and losses in the resonator arise only from the diaphragm. Taking into account diffraction at the diaphragm field, distributions are calculated inside the resonator whose central ray makes an angle α with the normal to the diaphragm. The center of the diaphragm is displaced from the central ray by a distance d. Expressions are derived for the natural frequencies of this resonator and its diffraction losses. It is shown that the transverse fields distributions of oppositely traveling waves inside a resonator with a diaphragm are different, but the losses and frequencies are identical. The results of this work may be useful for calculations of the frequency nonreciprocity of the oppositely traveling waves in a ring laser with a misaligned resonator. (auth)

17109 THIRD-ORDER INTENSITY CORRELATIONS IN LASER LIGHT. Corti, M.; Degiorgio, V. (CISE, Milan). Opt. Commun.; 11: No. 1, 1-4(May 1974).

The third-order intensity correlation function of a single-mode laser beam has been measured with high accuracy near the laser threshold by using a fast digital correlator. The results are in good agreement with recent theoretical computations. (auth)

17110 AMMETER FOR THE NON-DESTRUCTIVE MEASUREMENT OF HIGH CURRENTS IN SUPERCONDUCTORS. Blair, D. G.; Hamilton, W. O.; Hymel, B. C.; Stewart, B. B. (Louisiana State Univ., Baton Rouge). Cryogenics; 15: No. 3, 119-120(Mar 1975).

The construction and operation of an ammeter for the measurement of supercurrents is described. The ammeter consists of an LC circuit whose inductance is modulated by the proximity of a niobium diaphragm which is deflected away from a current carrying conductor. Resulting changes in its resonant frequency are related to the magnitude of the current in the conductor. Calibration and alternate methods of operation are described. (auth)

17111 FREQUENCY LOCKING IN A 3.39μ LASER. Andreeva, E.Yu.; Gulyaev, S.N.; Terekhin, D.K. (M. I. Kalinin Leningrad Polytechnical Institute). Sov. Phys.—Tech. Phys. 19: No. 12, 1620-1621 (June 1975).

An experimental investigation of the synchronization of a laser with linear polarization is described for two cases: 1) the polarization of the laser radiation is linear and orthogonal to the polarization of the input signal, and 2) the laser radiation is circularly polarized. It is shown that the interaction of the radiation with different polarization leads to frequency locking. When the input signal interacts with a laser that exhibits frequency splitting, locking occurs only when the amplitude of the input signal exceeds a certain threshold value. (auth)

17112 EFFECT OF A MAGNETIC FIELD ON SPONTANEOUS MODE-LOCKING IN A He—Ne LASER (λ=0.63μ). Petrun'kin, V.Yu.; Nikolaev, V.M.; Kotov, O.I.; L'vov, B.V. (M.I. Kalinin Polytechnical Institute, Leningrad). Sov. Phys.—Tech. Phys. 19: No. 12, 1612-1613 (June 1975).

The effect of an axial magnetic field on the coupling of the longitudinal modes in a gas laser is investigated experimentally. For magnetic field values at which splitting occurs between the σ components of the gain curve (the gain is equal to the basic separation modes or is a multiple of an odd number of these separations) the laser operates in a stable self-locking type II mode. It is shown that the width of the resonant spontaneous locking region depends on the cavity geometry and the magnitude of the excitation. (auth)

17113 LARGE VOLUME TEA CO_2 AMPLIFIER. Domey, J. (Gen-Tec Inc., Quebec). Rev. Sci. Instrum.; 46: No. 7, 811-813 (Jul 1975).

A 15 x 15 cm cross section, 50 cm long, TEA CO_2 amplifier using a reliable and simple discharge system is described. This system permits external control of the width of the discharge and is easily scalable. The spatial distribution of the small signal gain over the cross section of the amplifier was investigated. An average small signal gain coefficient of 0.022 cm^{-1} was obtained at an input energy density of 100 J/liter. Measurement of the saturated energy gain is reported. The small signal gain was also measured on a smaller cross section but more heavily excited amplifier, using a similar discharge system. (auth)

17114 PASSIVE MODE-LOCKING IN FLASHLAMP-PUMPED DYE LASERS. Garside, B. K.; Lim, T. K. (McMaster Univ., Hamilton, Ont.). Opt. Commun.; 12: No. 3, 240-245(Nov 1974).

Passive mode-locking in flashlamp-pumped dye lasers is investigated employing a theoretical model presented previously. It is shown that under typical experimental conditions, the flashlamp-pumped dye laser can be operated in the quasi-continuous regime where the output pulses are close to being steady-state pulses (SSP). Numerical results concerning the build-up process of the SSP are generally in good agreement with experimental observations. (auth)

17115 OPERATING CHARACTERISTICS OF A LINEAR FLASHLAMP-PUMPED DYE LASER USING A COAXIAL DYE CELL. Drake, J. M.; Morse, R. I. (Clark Univ., Worcester, MA). Opt. Commun.; 12: No. 2, 132-135(Oct 1974).

The use of a coaxial dye cell in a linear flashlamp pumped dye laser is discussed. The characteristics of the flashlamps used are reported, illustrating the variation in peak power and energy at different emission wavelengths of the xenon discharge. Thermal lensing, encountered when using a coaxial dye cell is reported and its effect on the performance of the laser is demonstrated. (auth)

17116 THERMODYNAMICS OF ADIABATIC LASER PROCESSES: OPTICAL HEATERS AND REFRIGERATORS. Kafri, O.; Levine, R. D. (Hebrew Univ., Jerusalem). Opt. Commun.; 12: No. 2, 118-122(Oct 1974).

A thermodynamic operating condition for lasing (in the presence of losses) is derived. This provides a lower bound for the required density of systems in the emitting level. Efficient cooling enables one to reduce this bound. The results are shown to be a particular application of the thermodynamic limitations on heating or refrigeration achieved via luminescence. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 17295, 17915, and 17916.

17117 (BNL-19742) SUPERCRITICAL HELIUM REFRIGERATOR FOR SUPERCONDUCTING POWER TRANSMISSION CABLE STUDIES. Dean, J. W.; Jensen, J. E. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 9p. (CONF-750716-5). Dep. NTIS $4.00.

From international cryogenic materials conference; Kingston, Ontario, Canada (22 Jul 1975).

A laboratory size refrigeration system to study cooling methods, cryogenic enclosures, and short lengths of superconducting power transmission cables is described. The system has been constructed with several novel features which improve the cool-down efficiency of long lines and also simplify the enclosure design. Data accumulated under various operating conditions is presented and discussed with relation to the ongoing cable program. (auth)

17118 (NP-20400) STUDY OF THE MARKETS FOR LARGE ROTATING ELECTRICAL MACHINERY, 1970—2000. (Little (Arthur D.), Inc., Cambridge, Mass. (USA)). Feb 1973. 90p. Arthur D. Little, Inc., Cambridge, MA.

A study was made of the U. S. market for large rotating electrical machinery for the period 1970 through 2000. Information and informed opinions are provided in response to a series of questions related to the development of superconducting motors and generators; the probable relationships of such developments with the U. S. balance of trade, environmental considerations, and economic impact. The findings are discussed. (MOW)

17119 ENERGY STORAGE WITH SUPERCONDUCTING MAGNETS. Heinz, W. (Inst. Experimentelle Kernphysik, Karlsruhe, Ger.). Elektrotech. Maschinenbau; 90: No. 9, 430-434(Sep 1973). (In German).

The means of storing electrical energy and their economics are discussed. Energy stores, e.g., capacitance, inductance (superconducting), water reservoir, electric generator (iron rotor), electrochemical battery, and chemical reaction energy are compared with respect to energy density, specific cost, typical current rise and discharge times. The author discusses superconducting energy storage installations (doughnut fusion reactor, sphere-shaped store with cryosystem), associated problems, e.g., arrangements for emergency shutdown, behavior of superconductors, structural materials and cooling media under high-voltage conditions. (Elec. Electron. Abstr.)

17120 THIN-FILM DC SQUID WITH LOW NOISE AND DRIFT. Clarke, J.; Goubau, W.M.; Ketchen, M.B. (Department of Physics, University of California, Berkeley, California 94720). Appl. Phys. Lett. 27: No. 3, 155-156 (1 Aug 1975).

We describe the fabrication and operation of thin-film dc SQUID's of cylindrical geometry that make use of shunted Nb-NbO_x-Pb tunnel junctions. A typical noise power spectrum is shown. At frequencies between 2×10^{-2} Hz and the electronic roll-off frequency, the flux resolution is 3.5×10^{-5} $\phi_0/(Hz)^{1/2}$, corresponding to a magnetic field resolution of 10^{-10} $G/(Hz)^{1/2}$. This resolution appears to be set by intrinsic sensor noise. Below 2×10^{-2} Hz, the spectrum is approximately $1/f$. A 20-h plot of SQUID output as a function of time demonstrates an average drift of less than 2×10^{-5} ϕ_0/h. (auth)

17121 NEAR-FIELD EMISSION FROM GaAs DOUBLE-HETEROSTRUCTURE LASER MIRRORS. Hakki, B. W. (Bell Telephone Labs., Murray Hill, NJ). IEEE (Inst. Electr.

Electron. Eng.) J. Quant. Electron.; QE-11: No. 4, 149-154 (Apr 1975).

The near fields of GaAs double-heterostructure (DH) laser mirrors are studied both in photoluminescent (PL) excitation and in lasing emission. The various liquid-phase-epitaxial (LPE) layers of the laser diode are optically delineated, with ~0.1-mum resolution, in a wavelength-selective PL detection system. The near fields of the transverse lasing modes are correlated with the LPE layers that constitute the optical waveguide. With special emphasis on the large-cavity fundamental-mode PLN'N laser, it is found that small changes in refractive index within the waveguide have pronounced effects on the distribution of stimulated power within the LPE layers. The fundamental mode is found to be contained within the slightly higher refractive-index gain region. This explains the previously observed localization of catastrophic mirror damage and the anomalously large angles of beam divergence. High-order modes are also excited in the gain region when its thickness and refractive-index step within the waveguide exceed some prescribed limits. (auth)

17122 EFFECT OF EXTERNAL REFLECTORS ON LONGITUDINAL MODES OF DISTRIBUTED FEEDBACK LASERS. Streifer, W.; Burnham, R. D.; Scifres, D. R. (Xerox Palo Alto Research Center, CA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 4, 154-161 (Apr 1975).

The effect of external reflectors on longitudinal modes of distributed feedback (DFB) lasers is analyzed. The general case of dissimilar reflectors arbitrarily located relative to the phase of the DFB structure is considered. An eigenvalue equation for the propagation constants is derived and solved numerically for a variety of practical cases. Longitudinal mode thresholds, wavelengths, separations, and field distributions are obtained for GaAs lasers and for DFB lasers with a single reflector. It is shown that these quantities are very sensitive not only to the relative strength of the discrete and DFB, but also to the relative phases. Quite asymmetric transmitted powers are shown to occur under a variety of circumstances. (auth)

17123 REALIZATION OF A MODE-SELECTIVE THREE-MIRROR REFLECTOR. Eichler, H.; Schick, G.; Wiesemann, W. (Technische Univ., Berlin). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 4, 168-170 (Apr 1975).

A simple new mode-selective mirror configuration is realized for obtaining single-mode operation of a six-mode He/Ne laser. Stable single-mode operation could be maintained without active stabilization methods over periods of more than 5 min. (auth)

17124 DISCHARGE HEATED COPPER VAPOR LASER. Anderson, R. S.; Springer, L.; Bricks, B. G.; Karras, T. W. (General Electric Co. Space Sciences Lab., Valley Forge, PA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 4, 172-174 (Apr 1975).

A simple, reliable copper vapor laser is described with vapor produced by discharge heating. Average output power of 1.3 W has resulted at 6.8 kHz and a specific energy of 39 muJ/cm^3. Copper vapor density as high as 3×10^{16} cm^{-3} was achieved. (auth)

17125 PHOTOPREIONIZATION OF THE 3371-A PULSED N_2 LASER. Kurnit, N. A.; Tubbs, S. J.; Bidhichand, K.; Ryan, L. W.; Javan, A. (Massachusetts Inst. of Tech., Cambridge). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 4, 174-176 (Apr 1975).

Photopreionization of the 3371-A pulsed N_2 laser by use of a seed gas of low ionization threshold and flashlamp excitation is observed to result in increased laser output and reproducibility. Preionization also increases the range of permissible operating pressures, enabling operation with atmospheric-pressure mixtures of N_2 and He without reduced intensity. (auth)

17126 REVIEW OF CURRENT LEADS FOR CRYOGENIC DEVICES. Buyanov, Y. L.; Fradkov, A. B.; Shebalin, I. Y. (Inst. of Physics, Moscow). Cryogenics; 15: No. 4, 193-200 (Apr 1975).

In this review, the present state of problems connected with the arrangement of current leads in cryostats is described. The methods of determining the heat flux along leads and also for finding their optimal geometry are presented. Various operating regimes of the leads are considered. The experimental results obtained are put in systematic order. Also existing designs of current leads are described. (auth)

17127 ^{3}He–^{4}He DILUTION REFRIGERATION. Nagano, H.; Asami, H. (Tokyo Univ. (Japan)). Inst. for Solid State Physics). Oyo Butsuri; 43: No. 3, 280-285 (Mar 1974). (In Japanese).

In ^{3}He–^{4}He dilution refrigeration, refrigerating capacity is proportional to T^2, and the attained temperature is lower than that by ^{3}He cryostat method, and constant temperature can be held for a long time without any effect of magnetic field. Therefore, the ^{3}He–^{4}He dilution refrigeration is an indispensable method for the studies in mK temperature range. This method is an important clue to study in the ultra-low temperature range below 1 mK. ^{3}He–^{4}He solution separates into two liquid phases below 0.86°K. The upper light phase is dense ^{3}He phase and the heavy phase is dense ^{4}He phase. Under adiabatic condition, the mixing of liquid ^{3}He and liquid ^{4}He lowers the temperature of solution. If the ratio of ^{3}He in the dense ^{4}He phase is held below 6.4% by separating ^{3}He atoms from the dense ^{4}He phase, ^{3}He atoms cross over the phase boundary into the dense ^{4}He phase, and at the same time, the solution temperature lowers. The most important structural element in a refrigerator is a heat exchanger. For the purpose of obtaining several tens millidegrees Kelvin, a heat exchanger of tube in tube type can be utilized. But when the temperature around 10 mK is sought, a step type heat exchanger is used. (JA)

17128 DEVELOPMENT OF A LARGE SUPERCONDUCTING MAGNET. Saito, R.; Kanamori, N.; Kazawa, Y. (Hitachi Ltd., Ibaraki (Japan)). Hitachi Works); Tada, N.; Kimura, H. Hitachi Hyoron; 56: No. 10, 961-976 (Oct 1974). (In Japanese).

A large superconducting magnet for research on 1,000 kW class MHD power generation has been completed recently. With race-track-shaped coils this remarkable magnet features high magnetic stored energy (60 MJ) and high magnetic field intensity (45 kG at the center and 67.5 kG on the conductor). In an operation test, which involved excitation up to the rated magnetic field and quick elimination of the magnetic stored energy, it showed satisfactory performance and characteristics. (auth)

17129 ANALYSIS OF LASER EMISSION IN Ho^{3+}-DOPED MATERIALS. Caird, J. A.; DeShazer, L. G. (Univ. of Southern California, Los Angeles). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; GE-11: No. 3, 97-99 (Mar 1975).

The oscillator strengths, transition rates, and branching ratios associated with known and potential laser transitions in trivalent holmium are discussed. Recently reported laser transitions between the $^5F_5$ and $^5I_8$ energy manifolds are found to have an abnormally low average oscillator strength, and an alternative explanation of the laser observation is suggested. (auth)

17130 MECHANISM OF SINGLE-FREQUENCY OPERATION OF THE HYBRID-CO_2 LASER. Gondhalekar, A.; Heckenberg, N. R.; Holzhauer, E. (Univ., Stuttgart). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No 3, 103-108 (Mar 1975).

The mechanism of a new method of obtaining high-power single-frequency pulses from a TEA-CO_2 laser is discussed. Measurements of the shape and monochromaticity of pulses from the hybrid laser which has both a TEA and a low-pressure gain section inside one resonator are presented. The mechanism of single-frequency operation of the hybrid laser is discussed with reference to numerical solutions of simplified rate equations. The low-pressure section provides gain only over a narrow range of frequencies so that a mode lying in that band-width builds up faster than neighboring modes to give a single-frequency pulse resembling in overall shape the normal TEA laser pulse. If the system is already lasing when the TEA discharge begins, the single-mode radiation already present rapidly grows to give a single-frequency pulse lacking a gain-switched peak. (auth)

17131 NaCl SURFACE REACTION IN CHEMICAL-LASER DEVICES. Petersen, A. B.; Wittig, C. (Univ. of Southern California, Los Angeles). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 3, 110-111 (Mar 1975).

Pronounced absorptions in the 8 to 17-mu m region are observed on surfaces of NaCl that are used as Brewster windows in chemical lasers that derive their excitation from the CS_2/O_2 reaction. Surface reaction involves species that are formed during the chemical and photochemical processes that are active in the system. Implications regarding other reactive systems (using either chemical or electrical excitation) are also discussed. (auth)

17132 HOLLOW-CATHODE-TYPE cw WHITE LIGHT LASER. Fujii, K. I.; Takahashi, T.; Asami, Y. (Seikei Univ., Tokyo). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 3, 111-114 (Mar 1975).

A stable cw white laser light consisting of red (6360 A, 6355 A), green (5378 A, 5338 A), and blue (4416 A) line spectra emitted from Cd ions has been obtained with an improved flute-type hollow-cathode He-Cd^+ laser tube and a broad-band optical cavity. The typical output-power level was about 10 mW, discharge conditions being 250 V and 0.6 amperes. (auth)

17133 SIXTEEN NEW IR LASER DYES. Webb, J. P.; Webster, F. G.; Plourde, B. E. (Eastman Kodak Co., Rochester, NY). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 3, 114-119 (Mar 1975).

Sixteen new IR laser dyes are reported. All lased successfully

under excitation from a simple linear flashlamp of about 700-ns rise time. Untuned lasing wavelengths ranged from 810 to 972 nm. Laser output pulse energies from the four best of these dyes were 5 to 15 times greater than from diethylthiatricarbocyanine iodide (DTTC), with peak output of about 50 mJ obtained from 128-J excitation. Solvent effects with four selected laser dyes are also discussed. (auth)

Heat Transfer and Fluid Flow

Refer also to abstracts 17912, 19168, and 19169.

17134 (AD/A-003036) CRITICAL HEAT FLUXES FOR CURVED AND STRAIGHT SURFACES DURING SUBCOOLED FLOW BOILING. Hughes, T. G. (Pennsylvania State Univ., University Park (USA). Applied Research Lab.). 7 Jun 1974. Contract N00017-73-C-1418. 161p. (TM-74-194). NTIS $6.25.

Experimental and analytical studies of the critical heat flux for subcooled flows of Freon 113 over concave, convex and straight surfaces were conducted. Correlation functions for the critical heat flux on each surface have been developed from an idealized model of the vapor bubble cycle in nucleate boiling. These functions have been evaluated and compared with data collected in an experimental apparatus, constructed as part of this investigation. Details of the apparatus design and operating procedures are given. (GRA)

17135 RADIATIVE HEAT TRANSFER BY MULTIPHASE MEDIUM WITH UNIFORM HEAT FLUXES. Hasegawa, S.; Echigo, R. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Tani, Y. Nippon Kikai Gakkai Rombunshu; 40: No. 334, 1664-1673(Jun 1974). (In Japanese).

Radiant heat transfer of laminar flow is discussed by examining physical meaning of various parameters in case of heating with uniform heat flux and a mixed phase flowing medium between a pair of parallel plates. Temperature distribution and heat transfer characteristics are calculated with a large system of computer. The following assumption was set on the heat transfer problem in the section of developing temperature and sufficiently developed velocity in the laminar flow of mixed phase flowing medium between parallel plates: (1) wall surfaces being heated with uniform heat flux and irregular emission surface of black body, (2) all physical properties being constant, (3) dispersing medium being small sphere and regarded as continuous medium with respect to radiation propagation (4) carrier fluid being transparent with respect to radiation, (5) velocity distribution of carrier fluid is not affected by the presence of dispersing medium, and (6) any chemical change of dispersing medium is not considered. The discussion on the physical meaning of parameters has led to that heat transfer characteristics can be improved by streamline flow, large loading ratio, and a parameter representing the ratio of radiation and conduction. Local Nusselt number rises after passing through the minimum. Heat transfer is best when optical thickness is near 2.0 under same loading ratio. Radiation shielding effect can be suppressed by selecting a proper loading ratio. (JA)

Materials Testing

Refer also to abstracts 17317 and 17340–17345.

17136 (Y-DA-6376) ACOUSTIC EMISSION: AN OVERVIEW. Wallace, S. A. (Oak Ridge Y-12 Plant, Tenn. (USA)). 22 Jul 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

The mechanisms and applications of acoustic emission testing are reviewed. A bibliography of selected literature covering the period 1967 to 75 is presented. (TFD)

17137 NON-DESTRUCTIVE DETECTION OF FAULTS IN CONVENTIONAL EXPLOSIVE FUSES. Ong, A. S.; Durvaldo, G. (Instituto Militar de Engenharia, Rio de Janeiro). Int. J. Appl. Radiat. Isot.; 26: No. 5, 313-314(May 1975).

A nondestructive on-line method using a $^{90}Sr-^{90}Y$ β particle transmission gauge is described for the detection of faults in explosive fuses. Collimator, ion-chamber, and electronic circuitry designs are given. The system can be built economically and needs little attention in operation. (UK)

17138 CAN REACTOR TEST-SYSTEMS BE USED FOR EFFICIENT PIPELINE NDT. de Sterke, A. (Roentgen Technische Dienst N. V., Rotterdam). Br. J. Non-Destr. Test.; 17: No. 4, 102-108(Jul 1975).

From NDT 1974 conference; Lancaster, Eng. (Sep 1974).

Although mechanized ultrasonic test systems have now been used for many years in pipe-mills, the application of such systems to workshops and field welds has made slow progress. On the contrary, in the nuclear field the need for base-line and periodic inspection of pressure vessels has accelerated the development, construction and use of highly sophisticated multiprobe ultrasonic test systems. The advantages and restrictions of automatic examinations are reviewed, and the possible introduction of multiprobe systems in the field of weld testing is discussed. (auth)

17139 TRACK AUTORADIOGRAPHY FOR SEALING TESTS ON AMPULES CONTAINING TRANSURANIUM ELEMENTS. Polyukhov, V. G.; Lyadov, G. D.; Syuzev, V. N. Sov. At. Energy (Engl. Transl.); 37: No. 5, 1197-1198(Nov 1974).

Translated from At. Energ. (USSR); 37: No. 5, 432-433(Nov 1974).

Transuranium element production requires prolonged irradiation of capsules containing starting materials in a reactor. There is a high probability that the sealing will fail resulting in the loss of valuable products and contamination of the system. A track autoradiographic method for testing the capsules is described. The capsule is placed in a glass tube; appropriate exposure (1 to 2 h) produces a visible image of the damaged shell. The tube is washed with nitric acid and etched in 5% HCl for 10 minutes at 20°C. The results of the method on a O-38 capsule containing ^{252}Cf are shown. (TFD)

Nuclear Explosions

Refer also to abstracts 17147, 17148, 17183, 17190, and 18252.

17140 (NVO-154) PROJECT RIO BLANCO DATA REPORT. (Continental Oil Co., Houston, Tex. (USA)). Jun 1975. 89p. (PNE-RB-69). Dep. NTIS $7.50.

Production test data are presented for an alternate reentry hole (RB-AR-2) directionally drilled into the lower chimney region from a surface location offset 1200 ft from the emplacement well. Previous tests indicated that no significant evidence of gas flow existed between the top and the two lower chimneys. Drawdown testing occurred between December 10 and December 16, 1974. The data presented are similar to those presented in NVO-148 in that they are preliminary and not accompanied by an interpretation of the test results. When the entire testing sequence is completed, all of the data will be analyzed, interpreted and published in a comprehensive report. Until that time, this document is made available to all individuals and organizations interested in the progress to date of Project Rio Blanco. The data presented includes gas and water production summaries, detailed gas, water and radionuclide production and injection disposal, temperature and pressure histories, gas composition analysis, and tracer analysis. (TFD)

17141 (PNE-RB-67) PROJECT RIO BLANCO: DETONATION RELATED ACTIVITIES. Final Report. (CER Geonuclear Corp., Las Vegas, Nev. (USA)). 30 Jun 1975. 101p. Dep. NTIS $8.25.

Project Rio Blanco is described in relation to detonation, its history, execution, and results. Topics discussed include generalized site activities, emplacement well, explosive services and operations, operational safety, environmental protection program, seismic effects and damage claims, and add-on programs. (TFD)

17142 (TID-3522-R9-53) SELECTED, ANNOTATED BIBLIOGRAPHY OF THE CIVIL, INDUSTRIAL, AND SCIENTIFIC USES FOR NUCLEAR EXPLOSIONS. Kelly, R. C. (comp.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 69p. Dep. NTIS $5.45.

This supplement to bibliography TID-3522 (9th Rev.) contains 257 references to reports and published literature on the USERDA's Plowshare Program that were published in Volumes 28, 29, and 30 (July 15, 1973 to Dec. 31, 1974) of Nuclear Science Abstracts. The references are arranged by subject category, Experiment, Corporate Author, Personal Author, Subject, and Report Number Indexes are included. (auth)

17143 (UCID-16792) ONE-DIMENSIONAL CALCULATIONS: HIGH-EXPLOSIVE/NUCLEAR EFFECTIVENESS COMPARISONS IN WEAK TUFF. Snell, C. M.; Bryan, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1975. Contract W-7405-Eng-48. 32p. Dep. NTIS $4.75.

One-dimensional Lagrangian computer calculations have been performed to model the effects of buried high-explosive and nuclear detonations in weak saturated tuff. Fundamental differences between shock propagation and energy coupling mechanisms for the nuclear and high-explosive detonations were noted. The nuclear source was found to induce high peak stresses and particle velocities in the tuff environment, but long-term transfer of kinetic energy to the rock was more efficient for the high-explosive calculations. Total mound kinetic energy and long-lived

material velocities are the most important factors that control crater formation from optimum-depth explosive detonations. Therefore, it is judged that the cratering effectiveness of a nuclear event will be correctly simulated by a high-explosive detonation of about 60 percent the nuclear energy yield. Integrated shock effects, degree of rock fracturing, and all interactions that occur over a time scale greater than a few milliseconds were properly matched with this similitude factor. However, peak velocities at the shock front were higher for the nuclear case; the transient shock peak and long-term dynamic effects cannot both be accurately modeled at the same time in this medium. (auth)

17144 (UCRL-Trans-10853) PROBLEM OF A SPHERICAL PISTON IN AN ELASTOPLASTIC MEDIUM. Bashurov, V.; Skorkin, N. Translated from Chislennye Metody Mekh. Sploshnoi Sredy; 5: No. 5, 5-19(1974). 19p. Dep. NTIS $4.00.

17145 ARRANGEMENT FOR SIMULATING ELECTRICAL RADIATION AND LIGHT FROM NUCLEAR EXPLOSIONS. Fruengel, F. Canadian Patent 964,367. 11 Mar 1975. 12p.

A portable arrangement for simulating the electromagnetic pulse and light of a nuclear explosion is described. An antenna circuit has an inductance and a charging capacitor. A spark gap is connected in parallel with the capacitor. To simulate the electromagnetic pulse, the capacitor is charged from a high voltage until breakdown occurs across the spark gap, thereby causing the EMP to be radiated from the antenna. An electronic timing circuit is connected to the capacitor and furnishes a signal igniting a flash a predetermined time interval after creation of the EMP. A second timing circuit initiates a second flash a predetermined time interval following the first flash. The EMP and first flash test the nuclear detection sensor, while the second tests the operation of a protective shutter associated with the sensor. (Patent Office Record)

17146 NUCLEAR EXPLOSION TECHNIQUES FOR THE FORMATION OF OIL STORAGE CAVITIES. Despois, J.; Nougarede, F. Petrol. Times; 79: No. 2007, 21-22(16 May 1975).

A summary is presented of an economic feasibility study of offshore storage of oil in nuclear-made caverns. In the example studied, the location was outside a port which included an existing fully equipped terminal for unloading oil tankers. The storage capacity envisaged was about 70 million barrels. It is shown that (in this example) the minimum cost is attained with 13 explosions, each of about 250 kilotons, at a distance of about 45 miles from the coast. The cost of storage in the circumstances defined in the summary would be about $1.50 per barrel, which is stated to be highly competitive with conventional techniques. (UK)

Protective Structures and Equipment

Refer also to abstracts 17172, 17244, 17911, and 19119.

17147 (AD-775467) PROCEEDINGS OF ERIC H. WANG SYMPOSIUM ON PROTECTIVE STRUCTURES TECHNOLOGY, HELD AT KIRTLAND AIR FORCE BASE, NEW MEXICO, ON 21-23 JULY 1970. Volume I. Selheimer, H. E. (Air Force Weapons Lab., Kirtland AFB, N. Mex. (USA)). Mar 1971. 348p. (CONF-700735-P1; AFWL-TR-71-193-Vol-1). NTIS $20.50.

The report is divided into six sections; one for each session of the symposium. Each address or paper is as the speaker presented in his manuscript. Because of its length the proceedings are contained in two volumes: sessions I through 4 in volume one, and sessions 5 and 6 in volume two. Broad topics discussed in volume one include the following: airblast interactions; material properties; and ground motions. (GRA)

17148 (AD-775468) PROCEEDINGS OF ERIC H. WANG SYMPOSIUM ON PROTECTIVE STRUCTURES TECHNOLOGY, HELD AT KIRTLAND AIR FORCE BASE, NEW MEXICO, ON 21-23 JULY 1970. Volume II. Selheimer, H. E. (Air Force Weapons Lab., Kirtland AFB, N. Mex. (USA)). Mar 1971. 251p. (CONF-700735-P2; AFWL-TR-71-193-Vol-2. NTIS $15.75.

This report contains the addresses and papers presented at the symposium. The papers reflect the state of the art in the areas of airblast interaction, material properties, ground motions, structure-media interaction and structural response, and cratering and simulation as they relate to nuclear explosions. Broad topics discussed in volume two include the following topics: structural media interaction and structural response; and cratering, and simulation. (GRA)

17149 (CONF-740807-P1) PROCEEDINGS OF THE THIRTEENTH AEC AIR CLEANING CONFERENCE, SAN FRANCISCO, CALIFORNIA, 12-15 AUGUST 1974. First, M. W. (ed.). (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. 655p. Dep. NTIS $13.60.

Thirty-eight papers were presented at the conference and included in Volume 1. A separate abstract was prepared for each of 35 papers. The remaining papers appeared previously in NSA. For abstracts of these papers see 31:22151, 31:24657, and 31:25001. (RCK)

For abstracts of individual papers see: 16922-16925, 16950, 17150-17164, 17908, 18844, 18865, and 19116-19127.

17150 (CONF-740807-P1, pp 320-339) VENTILATION DESIGN FOR NEW PLUTONIUM RECOVERY FACILITY. Oliver, A. J.; Amos, C. L. (Dow Chemical U.S.A., Golden, CO). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

In 1972 the Atomic Energy Commission (AEC) issued revised guidelines on "Minimum Design Criteria for New Plutonium Facilities." With these criteria as guidelines, a new Plutonium Recovery Facility is being designed and constructed at the AEC Rocky Flats Plant. The methods by which the confinement of contamination and air treatment are being handled in this facility are described. (auth)

17151 (CONF-740807-P1, pp 340-352) DESIGN OF VENTILATION AND AIR CLEANING SYSTEMS FOR THE NEW LOS ALAMOS PLUTONIUM FACILITY. Mitchell, R. (Los Alamos Scientific Lab., NM); DeField, J.; Stafford, R.; McNeese, W.; Eberhardt, W.; Laushkin, N. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The Los Alamos Scientific Laboratory's new plutonium facility will conform to AECM Appendix 6301-Part II, Section H-Minimum Design Criteria for New Plutonium Facilities. The glove box process exhaust air is filtered through three or four stages of HEPA filters. The design of this multi-stage filter installation is shown with a method of in-place testing of each stage individually. A glove box filter holder and the in-place test procedure is described. General room air from plutonium work areas is recirculated at the rate of eight air changes per hour with a 10 percent fresh air make-up. The filter plenums for the recirculated air are designed to permit in-place testing of each of the two filter stages. (auth)

17152 (CONF-740807-P1, pp 353-371) VENTILATION DESIGN MODIFICATIONS AT LOS ALAMOS SCIENTIFIC LABORATORY MAJOR PLUTONIUM OPERATIONAL AREAS. Stafford, R. G.; Gallimore, J. C. Jr.; Mitchell, R. N.; Maraman, W. J.; McNeese, W. D. (Los Alamos Scientific Lab., NM). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Major ventilation design modifications in plutonium operational areas at Los Alamos have occurred during the past two years. An additional stage of HEPA filters has been added to DP West glove-box process exhaust resulting in significant effluent reductions. The additional stage of HEPA filters is unique in that each filter may be individually DOP tested. Radiological filter efficiencies of each process exhaust stage is presented. DP West room air ventilation systems have been modified to incorporate a single stage of HEPA filters in contrast to a previous American Air Filter PL-24 filtration system. Plutonium effluent reductions of 10^2 to 10^3 have resulted in these new systems. Modified DOP testing procedures for room air filtration systems are discussed. Major plutonium areas of the CMR Building utilizing Aerosolve 95 process exhaust filtration systems have been upgraded with two stages of HEPA filters. Significant reductions in effluent are evident. A unique method of DOP testing each bank of HEPA filters is discussed. Radiological efficiencies of both single and two-stage filters are discussed. (auth)

17153 (CONF-740807-P1, pp 372-388) PROPOSAL TO RECIRCULATE GLOVE BOX AND FABRICATION AREA AIR IN A PLUTONIUM FUEL FABRICATION PLANT. Philippi, H. M. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Recirculating glove box and fabrication area ventilation systems are proposed for a 40 Te/yr mixed plutonium–uranium oxide fuel fabrication plant. The ventilation design criteria are outlined, features of the fabricating plant relating to the ventilation system are shown and the recirculating systems are described. A method of operating and recirculating systems during unusual situations, energy conservation and system advantages are discussed. (auth)

17154 (CONF-740807-P1, pp 431-443) INERT ATMOSPHERE SYSTEM FOR PLUTONIUM PROCESSING GLOVEBOXES. Bogard, C. F.; Calkins, K. W.; Rogers, R. F. (Dow Chemical U.S.A., Golden, CO). Mar 1975.

From 13th air cleaning conference: San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Recent efforts to reduce fire hazards in plutonium processing operations are described. In such operations, the major environmental controls are developed through various kinds of glovebox systems. In evaluating the air-atmosphere glovebox systems, formerly in use at Rocky Flats and many other plants, a decision was made to convert to a recirculating "inert" atmosphere. The inert atmosphere consists of nitrogen, supplied from an on-site generating plant, diluting oxygen content to one to 5 percent by volume. Problems encountered during the change over included: determination of all factors influencing air leakage into the system, and reducing leakage to the practical minimum; meeting all fire and safety standards on the filter plenum and exhaust systems; provision for converting portions of the system to an air atmosphere to conduct maintenance work; inclusion of oxygen analyzers throughout the system to check gas quality and monitor for leaks; and the use of automatic controls to protect against a variety of potential malfunctions. The current objectives to reduce fire hazards have been met and additional safeguards were added. The systems are operating satisfactorily. (auth)

17155 (CONF-740807-P1, pp 445-465) AEROSOL FILTRATION BY FIBROUS FILTER MATS. Part III. Geometric Relations. Anderson, W. L. (Naval Weapons Lab., Dahlgren, VA); Magee, W. S. Jr.; Jonas, L. A. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The aerosol filtration characteristics of ten randomly formed fibrous filter mats, of widely varying compositions and physical properties, were studied as a function of both the superficial linear flow velocity and the aerosol diameter size. The flow regime ranged from 7.2 to 141 cm/sec with ten discrete velocities. Four diameter sizes of dioctylphthalate (DOP) aerosol were used to challenge the filter mats over this velocity range, namely, 0.26, 0.28, 0.30, and 0.32 microns. Mathematical equations, derived from the original Dorman aerosol equations, provided insight on the interrelationships between aerosol size, flow velocity, and the diffusion, interception, and inertia mechanisms of aerosol filtration. (auth)

17156 (CONF-740807-P1, pp 501-525) PERFORMANCE OF MULTIPLE HEPA FILTERS AGAINST PLUTONIUM AEROSOLS. Gonzales, M.; Elder, J.; Ettinger, H. (Los Alamos Scientific Lab., NM). Mar 1975.

From 13th air cleaning conference: San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Performance of multiple stages of High Efficiency Particulate Air (HEPA) filters against aerosols similar to those produced by plutonium processing facilities has been verified as part of an experimental program. A system of three HEPA filters in series was tested against $^{238}PuO_2$ aerosol concentrations as high as 3.3×10^{10} d/s-m^3. An air nebulization aerosol generation system, using ball milled plutonium oxide suspended in water, provided test aerosols with size characteristics similar to those defined by a field sampling program at several different AEC plutonium processing facilities. Aerosols have been produced ranging from 0.22 mu m activity median aerodynamic diameter (amad) to 1.6 mu m amad. The smaller size distributions yield 10 to 30 percent of the total activity in the less than 0.22 mu m size range allowing efficiency measurement as a function of size for the first two HEPA filters in series. The low level of activity on the sampler downstream of the third HEPA filter (approximately 0.01 c/s) precludes aerosol size characterization downstream of this filter. For the first two HEPA filters, overall efficiency, and efficiency as a function of size, exceeds 99.9 percent including the less than 0.12 mu m and the 0.12 to 0.22 mu m size intervals. Efficiency of the third HEPA filter is somewhat lower with an overall average efficiency of 99.8 percent and an apparent minimum efficiency of 99.5 percent. This apparently lower efficiency is an artifact due to the low level of activity on the sampler downstream of HEPA No. 3 and the variations due to counting statistics. Recent runs with higher concentrations, thereby improving statistical variations, show efficiencies well within minimum requirements. (auth)

17157 (CONF-740807-P1, pp 526-539) IN-PLACE TESTING OF MULTIPLE STAGE HEPA FILTER PLENUMS. Linck, F. J.; Geer, J. A. (Dow Chemical U.S.A., Golden, CO). Mar 1975.

From 13th air cleaning conference: San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Multiple stage High Efficiency Particulate Air (HEPA) filter plenums are required for plutonium processing facilities. A method used for dioctylphthalate (DOP) aerosol testing in multiple stage plenums at Rocky Flats is discussed. A brief review is presented on aspects of the plenum design which relate to filter testing. (auth)

17158 (CONF-740807-P1, pp 540-551) COMPARATIVE FILTER EFFICIENCY TESTING USING DIOCTYLPHTHALATE AND SODIUM CHLORIDE AEROSOLS. Jovanovic, O.; Vidmar, M; Tubic, M.; Patic, D.; Radosavljevic, R.; Smiljanic, R. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). Mar 1975.

From 13th air cleaning conferences; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Efficiencies of high efficiency particulate air (HEPA) filters were tested using dioctylphthalate (DOP) and sodium chloride (NaCl) aerosol methods. Commercial generator and detecting unit were used for the DOP test. In the NaCl test a commercial sodium flame photometer and home made generator were used. The aerosols produced and used in both DOP and NaCl tests had similar particle size distribution and MMD. Particle size distribution of both DOP and NaCl aerosols was determined by means of a six-stage Andersen cascade impactor. The MMD were determined from the cumulative per cent mass probability curves. The sodium chloride generator and its characteristics (production rate, particle size distribution and MMD) are described. (auth)

17159 (CONF-740807-P1, pp 552-564) FLAME GENERATION OF SODIUM CHLORIDE AEROSOL FOR FILTER TESTING. Edwards, J.; Kinnear, D. I. (United Kingdom Ministry of Defence, Salisbury, Eng.). Mar 1975.

From 13th air cleaning conference: San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A generator for sodium chloride aerosol is described, which when used in conjunction with a sensitive portable sodium flame detector unit, will permit the in-place testing of large filter installations having air throughputs up to about 80,000 m^3/h, at penetrations down to at least 0.005 percent. (auth)

17160 (CONF-740807-P1, pp 565-583) HIGH-EFFICIENCY PARTICULATE AIR (HEPA) FILTER PERFORMANCE FOLLOWING SERVICE AND RADIATION EXPOSURE. Jones, L. R. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Small HEPA filters were exposed to a ^{60}Co source with a radiation strength of 3×10^7 rads per hour and then exposed to steam–air mixtures at several times filter design flow, followed by extended exposure to steam and air at reduced flow. Additional filters

were exposed to air flow in a reactor confinement system and then similarly tested with steam–air mixture flows. The test data and calculated effects of filter pluggage with moisture on confinement system performance following potential reactor accidents are described. Gamma radiation exposure impaired the performance of new filters only slightly and temporarily improved performance of service aged filters. Normal confinement system service significantly impaired filter performance although not sufficiently to prevent adequate performance of the SRP confinement system following an unlikely reactor accident. Calculations based on measured filter pluggage indicate that during an accident air flow could be reduced approximately 50 percent with service-degraded HEPA filters present, or approximately 10 percent with new filters damaged by the radiation exposure. (auth)

17161 (CONF-740807-P1, pp 584-608) HEPA-FILTER SMOKE PLUGGING PROBLEM. Gaskill, J. R.; Magee, M. W. (Univ. of California, Livermore). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Actual experiences indicate that during the early stages of a fire, pyrolysis and incomplete combustion of organic materials used in the furnishings or interior finishes of laboratories yield copious quantities of smoke particulates, both liquid and solid. Furthermore, the use of fire retardants in materials used for the above purpose interferes with the combustion process, so that burning of such materials in later stages of a fire will yield dense smoke. These particulates can plug up a HEPA filter or even a more porous prefilter, and thus effectively shut off the exhaust ventilation. In this case, the fire room will pressurize and contamination may spread in an uncontrolled manner. Both small- and large-scale tests have been conducted to evaluate the nature and degree of the problem as a function of materials involved, rate of exposure to the fire, and kinds and temperatures of smoke so generated. Some test work has also been done on scrubbing of smoke. Proposed future work is described. (auth)

17162 (CONF-740807-P1, pp 609-619) EVALUATION OF MULTISTAGE FILTRATION TO REDUCE SAND FILTER EXHAUST ACTIVITY. Zippler, D. B. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Air from the Savannah River Plant Fuel Reprocessing facilities is filtered through deep bed sand filters consisting of 8½ feet of gravel and sand. These filters have performed satisfactorily for the past 18 years in maintaining radioactive release levels to a minimum. The apparent filter efficiency has been determined for many years by measurements of the quantity of radioactivity in the air stream before and after the filter. Such tests have indicated efficiencies of 99.9 percent or better. Even with sand filter efficiency approaching a single stage HEPA filter, new emphasis on further reduction in release of plutonium activity to the environment prompted a study to determine what value backup HEPA filtration could provide. To evaluate the specific effect additional HEPA filtration would have on the removal of Pu from the existing sand filter exhaust stream, a test was conducted by passing a side-stream of sand-filtered air through a standard 24 x 24 x 11½ in. HEPA filter. Isokinetic air samples were withdrawn upstream and downstream of the HEPA filter and counted for alpha activity. Efficiency calculations indicated that backup HEPA filtration could be expected to provide an additional 99 percent removal of the Pu activity from the present sand-filter exhaust. (auth)

17163 (CONF-740807-P1, pp 632-640) DEEP-BED SAND FILTER AT SAVANNAH RIVER LABORATORY. Moyer, R. A.; Crawford, J. H., Tatum, R. E. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A deep-bed sand filter was placed in service during June 1974 at the Savannah River Laboratory. This filter provides a back-up for HEPA filters in the primary exhaust system. HEPA filters can fail due to deterioration, faulty seating mechanisms, fire, and/or pressure excursions. The deep bed filter area is 103 ft by 140 ft and consists of layers of rock, gravel, and sand to a depth of 7 ft 6 in. Design flow is 74,000 cfm at 5.15 linear fpm. Most of the pressure drop occurs in the 36-in. layer of the "G" sand (sieve size No. 50 to No. 30) where the submicron particulates are captured. The filter is described, and operating characteristics are summarized, including pressure drops and filter efficiencies as determined with DOP. (auth)

17164 (CONF-740807-P1, pp 641-645) GOVERNMENT-INDUSTRY MEETING ON FILTERS, MEDIA, AND MEDIA TESTING. Anderson, W. L. (Naval Weapons Lab., Dahlgren, VA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The progress of a group of representatives from industry and government in solving problems related to particulate filters is reviewed. (LCL)

17165 (CONF-740807-P2) PROCEEDINGS OF THE THIRTEENTH AEC AIR CLEANING CONFERENCE, SAN FRANCISCO, CALIFORNIA, 12–15 AUGUST 1974. First, M. W. (ed.). (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. 502p. Dep. NTIS $13.60.

Thirty-two papers were presented at the conference and included in Volume 2. A separate abstract was prepared for each of 31 papers. The remaining paper appeared previously in NSA. For an abstract of this paper see 31:2500. (RCK)

For abstracts of individual papers see: 16926–16937, 17036, 17166–17172, 17180, 17181, 17242–17244, 17911, 19128–19131, and 19210.

17166 (CONF-740807-P2, pp 845-861) CALCULATION OF CHARCOAL HEATING IN AIR FILTRATION SYSTEMS. Bernard, E. A. (Los Alamos Scientific Lab., NM); Zavadoski, R. W. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AFC air cleaning conference. (USAFC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A computer program, TOOHOT, was developed to be used in the calculation of temperature increases in a charcoal filter when iodine is adsorbed in the filter. It employs an implicit computational technique and has stability and convergence characteristics which make it suitable for calculating temperatures for days of real time without excessive amounts of computer time. Calculational results are compared with similar results obtained at ORNL and found to give lower temperatures. TOOHOT includes the effect of oxidation heating which is calculated to be minimal for air velocities in excess of 4 fpm and depths of charcoal up to 8 in. Ignition is calculated to occur in the instantaneous loading case at an air velocity of 4 fpm. (auth)

17167 (CONF-740807-P2, pp 901-908) EVALUATION OF FIELD TEST EQUIPMENT FOR HALIDE AND DOP TESTING. Schreiber, K. L.; Kovach, J. L. (Nuclear Consulting Services Inc., Columbus, OH). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The Nucon Testing Services Department, field testing at power reactor sites, has performed tests using R-11, R-12, and R-112 in conjunction with gas chromatographs and direct reading halide detectors. The field operational experience with these detector systems, thus sensitivity, precision, and manner of field calibration, are presented. Laboratory experiments regarding ^{3}H-tagged methyl iodide for in place leak testing of adsorber systems indicate a low hazard, high reliability process for leak testing in facilities where atmospheric cross contamination occurs. (auth)

17168 (CONF-740807-P2, pp 1003-1028) EFFECT OF VARIOUS POLYMERIC BINDERS ON THE RADIATION RESISTANCE OF GLASS FIBER HEPA FILTER MEDIA. Hutten, I. M.; Oswecki, E. C. (Dexter Corp., Windsor Locks, CT). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA).

Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Glass fiber HEPA filter media bonded with various polymeric materials were exposed to several levels of radiation dosage from an electron beam source. The effects on water repellency, tensile strength, DOP filtration efficiency and organic content were noted. All media suffered degradation at the highest levels of radiation dosage (7×10^9 rads). However, at intermediate levels, radiation resistance was affected by the type of binder. Greatest resistance to radiation was exhibited by media bonded with a phenylated polysiloxane resin. Cross-linking polymers such as polystyrene and SBR displayed improvement in some properties, such as in water repellency and tensile strength, at low levels of radiation exposure (less than 2×10^9 rads), however degraded at higher levels of exposure. Filtration properties such as DOP efficiency and resistance to air flow did not appear to be greatly affected by radiolysis. (auth)

17169 (CONF-740807-P2, pp 1029-1038) ENHANCEMENT OF FILTER MEDIA PERFORMANCE BY CORONA-FREE ELECTRIC FIELDS. Bogardus, H. F.; Clark, R. C.; Thompson, J. K.; Fielding, G. H. (Naval Research Lab., Washington, DC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Dielectrophoresis is the movement of uncharged particles in a nonuniform electric field. Aerosol dielectrophoresis occurs when an aerosol and a glass fiber filter medium are exposed together to an electric field. The aerosol particles are polarized by the field, and experience a dielectrophoretic force in the field nonuniformities caused by the glass fibers. Motion of the particles is in the direction of the higher electric field intensity. Since the highest intensity is at the fiber surface, the particles are deposited there. Using a commercial fibrous glass filter medium between flat screen electrodes providing a field strength of 11 kv/cm, and at the manufacturer's rated pressure drop of 0.4 in. w.g., the filtration efficiency of the medium is increased from the normal 68 percent to 98 percent with a 0.3 micron aerosol, and from 78 to 99 percent for a one micron aerosol. This means that electrification decreases aerosol penetration of the medium by factors of 16 and 22, respectively. The results indicate the existence of a promising family of dielectrophoretic aerosol filters. Development has only begun, and the scope of the applications of dielectrophoretic filters will be determined by future scientific and engineering studies. (auth)

17170 (CONF-740807-P2, pp 1039-1046) CHARACTERIZING SAND GRAINS TO OPTIMIZE FILTER PERFORMANCE. Schurr, G. A.; Johnston, J. E. (E. I. du Pont de Nemours and Co., Newark, DE). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The operating performance of a deep-bed sand filter used for cleaning radioactive particulates from exhaust air is dependent upon the characteristics of the finest sand layer. This sand is usually specified on the basis of particle size distribution and air permeability. Recent studies have shown this specification is inadequate in providing a basis for selection of an optimum filter media. Sands obtained from different geographic deposits behave differently in the filter. The surface microstructure of the sand related to roughness or texture has been found to be an important variable in determination of the best sands for use as filter media. (auth)

17171 (CONF-740807-P2, pp 1056-1062) RESPIRATORY QUALITY ASSURANCE PROGRAM AT ROCKY FLATS. Skaats, C. D. (Dow Chemical U. S. A., Golden, CO). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The quality assurance program for all respiratory equipment at the Rocky Flats Plant, initiated in 1972, is described. Information is included on manpower requirements, test procedures, quantity of respirators checked, equipment used, and defects found. (LCL)

Safety Engineering

17172 (CONF-740807-P2, pp 911-926) INCINERATION PROCESS FIRE AND EXPLOSION PROTECTION. Ziegler, D. L. (Dow Chemical U. S. A., Golden, CO). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Two incinerators will be installed in the plutonium recovery facility under construction at the Rocky Flats Plant. The fire and explosion protection features designed into the incineration facility are discussed as well as the nuclear safety and radioactive material containment features. Even though the incinerator system will be tied into an emergency power generation system, a potential hazard is associated with a 60-second delay in obtaining emergency power from a gas turbine driven generator. This hazard is eliminated by the use of steam jet ejectors to provide normal gas flow through the incinerator system during the 60 s power interruption. (auth)

17173 (NP-20417) SODIUM RIG ENGINEERING: SAFETY PHILOSOPHY AND CODE OF PRACTICE. Delves, P. H. (UKAEA Reactor Group, Risley). Mar 1975. 14p. Dep. NTIS (US Sales Only) $4.00.

Due to increased interest in LMFBR's, more reactor design organizations are becoming involved in research and development utilizing liquid metals, and particularly sodium. Safety aspects of the design and operation of sodium test facilities are given. (TFD)

ENVIRONMENTAL AND EARTH SCIENCES

17174 (EPA-600/9-74-002) INDEXED BIBLIOGRAPHY OF OFFICE OF RESEARCH AND DEVELOPMENT REPORTS, UPDATED TO JANUARY 1975. (Environmental Protection Agency, Washington, D. C. (USA). Office of Research and Development). Mar 1975. 305p.

The bibliography is intended to provide a complete, current listing of the Office of Research and Development's final reports on in-house, grant, contract, and interagency projects. Reports are indexed by title, subject, performing organization, personal author, report number, and grant, contract, or interagency agreement number. (HLW)

17175 SULFUR DIOXIDE REACTIVITY OF COMMERCIAL LIMESTONES. Hartman, M. (Inst. of Chemical Process Fundamentals, Prague). Collect. Czech. Chem. Commun.; 40: No. 5, 1466-1477(May 1975).

Minerals and Ores

Refer also to abstract 16714.

17176 TREND SURFACE ANALYSIS OF Th, U, AND K, AND HEAT PRODUCTION IN THREE RELATED GRANITIC PLUTONS, FARSUND AREA, SOUTH NORWAY. Killeen, P. G.; Heier, K. S. (Univ. of Oslo). Chem. Geol.; 15: No. 3, 163-176(May 1975).

The radioelement concentrations and their distributions in the light (biotite hornblende) Farsundite and dark (charnockitic) Farsundite suggests that they are distinct plutons and not comagmatic. The trend surfaces of radioelement concentrations, coupled with available gravity data, indicates that the light Farsundite has a closer relationship to the Holum granite than to the dark Farsundite. Average radioelement concentrations for the three plutons suggests they are all part of a low heat production province which may be related to the low radioelement contents in the rocks of the Egersund area to the west. (NL)

17177 INNOVATIVE SYSTEMS FOR THE RECOVERY OF URANIUM. Lang, E. A. (Rocky Mountain Energy Co., Denver); Archibald, W. R. pp 114-118 of Mining Year Book, 1975. Denver; Colorado Mining Association (1975).

From National Western Mining Conference and Exhibition; Denver, CO (7 Feb 1975).

The use of bore hole hydraulic mining in the uranium industry is discussed. Means for improving the economics of resource grade material are considered. (LK)

17178 SEARCH FOR URANIUM: A PERSPECTIVE. Grutt, E. W. Jr. (Energy Research and Development Administration, Grand Junction, CO). pp 119-126 of Mining Year Book, 1975. Denver; Colorado Mining Association (1975).

From National Western Mining Conference and Exhibition; Denver, CO (7 Feb 1975).

The recent discovery statistics and projections of uranium demand for nuclear power indicate a pressing need now for expanding the resource base to assure an adequate economic future uranium supply. To date, the deposits in sandstone are the dominant type occurrences in the U. S., and they have accounted for over 95 percent of the production and reserves. As a result, the major part of the industry effort has been directed toward discovery and development of new deposits in this environment. Additional important discoveries will be made in the sandstones, but a vigorous search should be made for other types of deposits known elsewhere in the world. Such a search, to be successful, will require innovative exploration ideas and expansion of field investigations into prospective new geologic settings and areas. To complement and assist the industry efforts, the AEC has substantially increased the scope and effort of its work on uranium. This new program, called the National Uranium Resource Evaluation (NURE), includes activities such as contracted research and development to improve knowledge and concepts in geology, geochemistry, geophysics, and geostatistics; airborne surveys for uranium favorability; drilling for geological information; investigations of mining and metallurgical technology; and development of new geophysical instrumentation. The objectives are to provide for improved assessment of the U.S. potential uranium resources and identification of new areas favorable for uranium. In addition to this program, the AEC will continue to estimate the National Uranium Ore Reserves, and to forecast the production capability of the domestic industry in terms of available supply. (auth)

Radioactive Effluents

Refer also to abstract 16940.

17179 (BNWL-1950(Pt. 4), pp 81-82) TOXIC SUBSTANCES IN NUCLEAR FUELS. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

The long-term objective of this program is to characterize toxic materials present in the nuclear fuel cycle and to provide quantitative projections of the controlled accumulation and routine release of these materials. Detailed characterization of the amounts and the chemical, physical and radiological properties of toxic effluents is required to give guidance to biomedical and environmental research and development programs. Quantities and characteristics of pollutants associated with existing and future nuclear energy systems will form a basis for guiding these research programs and help to assure that source terms used are consistent with AEC expectations of the growth of nuclear power. This program was initiated in fiscal year 1975. The principal effort has emphasized characterizing toxic effluents from the light water reactor UO_2 fuel cycle. (auth)

17180 (CONF-740807-P2, pp 1047-1055) CONSIDERATION OF THE SIGNIFICANCE OF CARBON-14 DISCHARGES FROM THE NUCLEAR POWER INDUSTRY. Magno, P. J.; Nelson, C. B.; Ellett, W. H. (Environmental Protection Agency, Washington, DC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Carbon-14 is produced in nuclear power reactors by a variety of nuclear reactions. This ^{14}C becomes a potential constituent of reactor and reprocessing plant off-gas effluents. This presentation discusses the significance of these potential discharges and includes (a) an estimate of the amount of ^{14}C which may be produced, (b) projections of the tropospheric inventory which would result from continuous discharge of this ^{14}C, and (c) a comparison of the whole-body doses from discharges of ^{14}C and ^{85}Kr. This evaluation indicates a need to better define the amounts of ^{14}C discharged from the nuclear power industry. (auth)

17181 (CONF-740807-P2, pp 1105-1112) GOVERNMENT-INDUSTRY CONFFRENCF ON AIRBORNE RADIOIODINE. Burchsted, C. A. (Oak Ridge National Lab., TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The Working Group on Airborne Radioiodine met at AEC Headquarters on March 28, 1974. Dr. Alex Perge gave the introduction for the Division of Waste Management and Transportation, noting the Commission hopes that private industry will take a bigger share in the future in funding and initiating needed research; that there should be a greater effort in the direction of reducing the quantity of material that becomes contaminated as an avenue toward reducing the airborne radioiodine problem, and toward reducing the waste generated to a form suitable for direct storage; and that the Commission must ensure valid bases for future regulations governing airborne releases and contamination. Dr. First discussed the background of the review committee and its outgrowth from the earlier organization meeting. He noted that its function will be the coordination of efforts concerned with the radioiodine problem and the dissemination of information and research data. A major objective of this meeting was to identify subjects for discussion at the Government-Industry Conference of Adsorbers and Adsorbents which will be held in conjunction with the 13th AEC Air Cleaning Conference in August. Mr. Dempsey noted that the gaseous effluent program had been inherited by WMT from the Division of Operational Safety, and that an important function of these continuing meetings of the Working Group will be to guide WMT in the expenditure of funds and assignment of research related to the radioiodine problem. (auth)

17182 (JAERI-M-5903) PRESENT STATUS AND PROPOSED ENVIRONMENTAL SAFETY STUDIES FOR NUCLEAR POWER

DEVELOPMENT. Ishihara, T.; Imai, K.; Kitani, S.; Enomoto, S.; Sakata, S. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 82p. (In Japanese). INIS. NTIS (US Sales Only) $7.25.

The subjects to be studied in the field of environmental nuclear safety in JAERI for the next few years were discussed by a Special Committee of Environmental Nuclear Safety (October 1973 to April 1974), in the Board of Nuclear Safety Research, JAERI. This report describes, in this connection, (a) an outline of the present status of nuclear facilities and research activities, (b) subjects of study for JAERI for the nuclear power development. Covered are the following: evaluation of the environmental dose around a nuclear site, confinement of radioactivities released from nuclear facilities, management of radioactive waste and accident countermeasures in transportation. Utilization of activable tracer and application of radiation to environmental cleaning are also included. (auth)

17183 (NVO-294-5) ON-SITE RADIOLOGICAL PROGRAMS DURING REENTRY DRILLING THROUGH PRODUCTION TESTING, FINAL REPORT. (Eberline Instrument Corp., Santa Fe, N. Mex. (USA)). Dec 1973. Contract AT(26-1)-294. 38p. (PNE-R-66). Dep. NTIS $4.00.

Eberline Instrument Corporation provided radiological safety support for Project RULISON, the second experiment in which a nuclear explosive was used to stimulate the production of natural gas. This support included installation, calibration and operation of effluent monitoring systems, personnel dosimetry, contaminated waste handling and disposal, environmental sampling, survey and monitoring and exclusion area control. Pertinent data required by U. S. District Court action was evaluated, documented and published daily in an Open File Report. All of the above activities indicated that radioactive materials were controlled and disposed of in accordance with AEC guidance. (auth)

17184 FUNDAMENTAL POLICY ON THE ENVIRONMENTAL PROBLEMS OF NUCLEAR POWER PLANT. Kanda, S. (Agency of Natural Resources and Energy, Tokyo (Japan)). Karyoku Hatsuden; 25: No. 4, 401-411(Apr 1974). (In Japanese).

The environmental problem in nuclear power generation is concerned with its siting; which is then divided in two aspects, i.e., environmental radioactivity and heated-water discharge. This destruction of environment can be prevented by means of technology. The relation between human life and natural environment is first explained. The current status of two aspects, including technical possibilities, is then described. The examination of prospective sites and the points for solving the siting problem are mentioned. The effect of environmental radioactivity on human body is not known definitely, so "as low as practicable" should be guiding principle. Heated water is produced in turbine condensers, and then released into the sea. Since it affects biological life there, the manner of its discharge must be fully studied. (JA)

Radioactivity Monitoring and Transport

Refer also to abstracts 16722, 16756, 17182, 17462, 17577, 17594, and 17899.

17185 (BNWL-1950(Pt.4)) PACIFIC NORTHWEST LABORATORY ANNUAL REPORT FOR 1974 TO THE USAEC DIVISION OF BIOMEDICAL AND ENVIRONMENTAL RESEARCH. Part IV. Physical and Analytical Sciences. Nielsen, J. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Feb 1975. Contract AT(45-1)-1830. 122p. Dep. NTIS $5.45.

Separate abstracts were prepared for the 18 sections of the report. (CH)

For abstracts of individual papers see: 16697, 16698, 16735, 16756, 16943, 17179, 17189, 17194, 17196, 17221, 17240, 17401, 17452–17454, 17559, 17565, and 18324.

17186 (N-74-35237) SKYLAB NEUTRON ENVIRONMENT EXPERIMENT (SCIENCE DEMONSTRATION SD-34 (TV108)). Description and Preliminary Results. Fishman, G. J. (Teledyne Brown Engineering, Huntsville, Ala. (USA)). Apr 1974. 24p. (NASA-CR-120446; EE-SSL-1802). NTIS $4.25.

Neutron and proton induced radioactivity at various locations within Skylab were measured. Samples of five metals were formed into activation packets and deployed at the following locations on the Skylab 4 mission: orbital workshop film vault, water storage tank, and two opposing orbital workshop internal locations. Radioactive nuclides were produced in the packets by nuclear interactions of high-energy protons and secondary neutrons within Skylab. Low-level gamma ray spectroscopy measurements were made on the returned packets to determine the incident neutron and proton fluxes and spectra and their variations with mass distribution. (auth)

17187 (UCRL-51839) ATMOSPHERIC RELEASE ADVISORY CAPABILITY (ARAC): DEVELOPMENT AND PLANS FOR IMPLEMENTATION. Dickerson, M. H.; Orphan, R. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jun 1975. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

The Atmospheric Release Advisory Capability (ARAC) is an ERDA-sponsored service planned for nuclear facilities which require a means of real-time prediction of the extent of health hazards that may result from a release of radionuclides or other toxic materials. Since 1973 when the ARAC concept was initiated, a joint feasibility study has been conducted by Lawrence Livermore Laboratory and Savannah River Laboratory, and a prototype component of the system has been built and placed in operation. During the next three years plans are to implement the ARAC service for certain ERDA nuclear facilities. A brief description is presented of the ARAC concept, and progress to date is reported. (auth)

17188 ENVIRONMENTAL RADIOACTIVITY. Report of the Federal Government. Bundesrat–Drucksache; No. 7/929, 1-23 (Jul 1973). (In German).

15 figs.; 3 tabs.

Report of the Federal Government on environmental radioactivity and radiation exposure of the population of the German Federal Republic in 1972. (GE)

Atmosphere

Refer also to abstracts 16758, 16947, 17180, and 17242–17244.

17189 (BNWL-1950(Pt. 4), pp 33-34) FAST REAL-TIME MEASUREMENT OF EXTREMELY LOW-LEVEL AIRBORNE PLUTONIUM. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

A small mass spectrometer with a direct air-inlet to the ion source region is being developed to detect and measure individual submicrometer ^{239}Pu-bearing particles in ambient air. The instrument will be capable of measuring plutonium concentrations below the MPC level. Development of the inlet and the readout system for the spectrometer is in progress. (auth)

17190 PROGNOSIS OF LOCAL RADIOACTIVE FALLOUT FROM SURFACE NUCLEAR EXPLOSIONS UNDER IDEALIZED METEOROLOGICAL CONDITIONS. Vojvodic, V. Naucno-Teh. Pregl.; 21: No. 10, 43-57(1971).

A relatively simple mathematical model is presented for the prediction of local radioactive fallout from surface nuclear explosions. The model is based on the aeromechanical similarity of phenomena of radioactive clouds and evaluation of deposition of radioactive fallout. (auth)

17191 RETENTION OF AIRBORNE RADON DAUGHTERS AFTER COLLECTION ON A FILTER MEDIUM. Halmgren, R. M.; Lloyd, R. D.; Pendleton, R. C. (Univ. of Utah, Salt Lake City). Health Phys.; 28: No. 6, 823-824(Jun 1975).

When airborne radioactivity is sampled by pumping air through a filter at a known volumetric rate, factors for which allowance must be made in the calculations include the fractional retention of activity on the filter after its initial deposition. To assess this factor, re-entrainment of radon daughters on a 2-in.-dia cellulose-asbestos fiber filter (HV-70) was measured. It was found that re-entrainment of ^{214}Pb + ^{214}Bi collected from the air on the HV-70 filter by a flow rate of about 25 l/min through a 2-in. disc (about 1300 cm/min linear flow) is small. This indicates that the retention of the activity once it is deposited on the filter is essentially 100%, so that no correction for the re-entrainment effect need be made under these circumstances. (UK)

17192 CORRELATION BETWEEN AIR RADIOACTIVITY AND AIR MASSES IN GREECE DURING THE PERIOD 1964–1972. Danali, S.; Papayannakis, S. (Atomic Energy Commission, Athens). Health Phys.; 28: No. 6, 727-732(Jun 1975).

Daily radioactivity measurements of air samples collected in Athens, Greece, have been performed continuously since 1964. Correlation of such determinations with meteorological data has resulted in some interesting conclusions. The atmospheric nuclear testing of the early 1960s caused elevated levels of air radioactivity in Athens. The highest annual value for air radioactivity in this study was for 1964 when the value was 1.06 pCi/m^3. A general decrease in air radioactivity was noted in ensuing years with the mean annual value dropping to 0.12 pCi/m^3 for 1972. Correlations of daily air radioactivity determinations with meteorological data

have shown that movements and origins of surface air masses result in changes in air radioactivity levels. Mediterranean air masses or masses of air arriving by a Mediterranean pathway seem to carry more radioactive material than other pathways studied. An inverse correlation was found between the frequency of air mass variations and quantity of radioactive material, i.e., the lower frequency air mass variations tend to carry larger amounts of radioactive material. (auth)

17193 BURDEN OF VOLCANIC DUST AND NUCLEAR DEBRIS AFTER INJECTION INTO THE STRATOSPHERE AT 40°–58°N. Volz, F.E. (Air Force Cambridge Research Laboratories, Hanscom Air Force Base, Bedford, Massachusetts 01731). J. Geophys. Res. 80: No. 18, 2649-2652 (20 June 1975).

Meridional profiles of turbidity at some periods after the explosion of Katmai volcano in June 1912 at 58°N are compared with debris burden from Chinese nuclear tests. Katmai turbidity was previously obtained from solar radiation data, and debris burden was calculated from published mixing ratio data. Turbidity and burden generally peak strongly in arctic latitudes. Only two tests show indications of a bulge at 30°–45°N which probably existed for Katmai dust in spring 1913. The residence time of Katmai dust was found to have been about 1 year, whereas fallout of nuclear debris seems not to have started before the winter following the tests. For September 1912 the total amount of Katmai aerosol is estimated to have been 13 million metric tons. Analogies to predicted meridional distribution of SST pollutants are being mentioned. (auth)

Soil

Refer also to abstract 18182.

17194 (BNWL-1950(Pt. 4), pp 12-16) IN SITU MONITORING. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Systems for in situ analysis of radionuclides around storage areas and nuclear sites are being developed. The development and initial use of a Ge(Li) system for down well radioactivity measurements was completed. Design criteria were developed and construction begun on a ^{90}Sr counter for use on natural soils. (auth)

17195 (DP-MS-74-65) FIELD STUDY TO OBTAIN PLUTONIUM CONTENTS OF OLD FIELD VEGETATION AND SOIL UNDER HUMID CLIMATIC CONDITIONS. Pinder, J. E.; Smith, M. H.; McLendon, H. R.; Boni, A. L.; Horton, J. H.; Corey, J. C. (Savannah River Ecology Lab., Aiken, S. C. (USA)). 1975. Contract AT(07-2)-1. 7p. (CONF-750503-23). Dep. NTIS $4.00.

From fourth national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

Soil and vegetation at the Savannah River Plant were analyzed for plutonium. The data indicate that vacuumed samples have the greatest concentration of plutonium, that resuspension and fallout of plutonium is a principal contributor to the plutonium concentration of vegetation because the ^{238}Pu concentrations are more closely aligned to source term values than soil values under field conditions, and that laboratory uptake studies may underestimate the plutonium content of vegetation growing under field conditions adjacent to a fuel reprocessing facility. (HLW)

Water

Refer also to abstract 17573.

17196 (BNWL-1950(Pt. 4), pp 35-36) ANALYTICAL TECHNIQUES FOR MEASUREMENT OF ^{99}Tc IN ENVIRONMENTAL SAMPLES. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Mass spectrometry promises greater sensitivity for measurement of ^{99}Tc in the environment than any method previously reported. During the first 5 months of this study $^{99}Tc^{+}$ ion beam intensities have been obtained which indicate that picogram and sub-picogram measurements may indeed be feasible. Further studies of ionization source design, operating parameters, and other factors affecting measurement sensitivity are being conducted. (auth)

17197 MEASUREMENTS OF DEPOSITION VELOCITY OF GASEOUS ELEMENTAL IODINE ON WATER. Allen, M. D.; Neff, R. D. (Texas A and M Univ., College Station). Health Phys.; 28: No. 6, 707-715(Jun 1975).

The deposition properties of gaseous elemental iodine on water were studied in a small, plexiglas wind tunnel. The amounts of stable iodine deposited in the water and collected from the air on charcoal were determined using activation analysis, allowing values of deposition velocity to be calculated under various controlled conditions. Deposition velocity on water was found to increase linearly with increasing wind velocities over a range of wind speeds typical of most environments. Both the pH and water temperature had a pronounced effect on the deposition rate. Water with a slightly basic pH was about three times better as a collection surface than water with a slightly acidic pH. Measured values of the deposition velocity increased almost linearly with increasing water temperature. Differences in the deposition rate due to pH and water temperature variations were attributed to the changes they caused in the iodine solubility in water. (auth)

Ecosystems and Food Cycles

Refer also to abstracts 16696, 16765, 17257, and 17587.

17198 OCCURRENCE OF STRONTIUM-90 IN LIVING CORAL FROM THE NORTHERN GULF OF MEXICO. Griffin, L. L.; Myers, J. K.; Carlyle, D. C.; Suttle, A. D. (Univ. of Texas, Galveston). Health Phys.; 28: No. 6, 693-697(Jun 1975).

Strontium-90 was extracted from Montastrea cavernosa coral that had been living on the West Flower Garden Bank submerged reef (lat 27° 52.6 N, long 93° 49.0 W) in the northern Gulf of Mexico in 1972. The calculated ^{90}Sr activity level in the sampled coral is 0.5 ± 0.2 dis/min/g of coral ash or 0.11 ± 0.05 pCi/g wet coral. This level is larger than, but the same order of magnitude as, ^{90}Sr radioactivity levels found in 1967 seawater samples from deeper locations in the Gulf of Mexico. It is thought that the composition of seawater in the Flower Garden vicinity is representative of water along the outer continental shelf of the Texas Gulf Coast, so that the existence of ^{90}Sr in coral from the Flower Garden indicates a correlative low level presence of that nuclide in such water. (auth)

17199 ^{210}Po AND ^{239}Pu, ^{240}Pu IN BIOLOGICAL AND WATER SAMPLES FROM THE BIKINI AND ENIWETOK ATOLLS. Nevissi, A.; Schell, W. R. (Univ. of Washington, Seattle). Nature (London).; 255: No. 5506, 321-323(22 May 1975).

Measurements of the radioactivity in water and biological samples from the lagoons indicate that although the samples were collected from the most Pu-polluted waters in the world values of the naturally produced radionuclide ^{210}Po were usually greater than the values for ^{239}Pu and ^{240}Pu by factors as high as 100. Results are shown tabulated. Once in the aquatic environment Po and Pu undergo chemical and physical changes that may not be similar for the two elements, but both accumulate in algae, planktons, vertebrates and invertebrates. The results given apply mainly to fish. (UK)

17200 KONTAMINATION UND DEKONTAMINATION VON LEBENSMITTELN. (Contamination and Decontamination of Food. Conference Held at Karlsruhe, Germany, June 2–4, 1970). Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs- und Informationsdienst e.V.) (1974). 340p. (CONF-700685–).

Twenty one papers presented and the discussions following them are compiled. Sample storage and efficiency of analytical techniques are considered in papers not abstracted separately. Separate abstracts were prepared for 19 papers. (JSR)

For abstracts of individual papers see: 16722, 16765, 16910, 17201–17207, 17257, 17278, 17519, 17581–17583, and 17587–17589.

17201 ORIGIN AND TYPES OF RADIOACTIVE CONTAMINATION OF FOOD. Fischer, E. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp 13-30 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs- und Informationsdienst e.V. (1974)). (In German)

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685–.

The three most dangerous sources of food contamination are nuclear war incidents, reactor accidents, and heat sources and generators using radioisotopes. The types of contamination resulting from each are discussed with emphasis on explosions. The physical and radiochemical properties of fallout particles from different types of nuclear explosives are tabulated and discussed with respect to the contamination expected. The activity distribution in fallout at different times after a nuclear explosion is analyzed briefly. The uptake by various plants of ^{90}Sr, ^{131}I, and ^{137}Cs is considered. Possible decontamination methods and precautions to be taken with plant and animal food are outlined. (JSR)

17202 EFFECTS OF THE CHINESE NUCLEAR EXPLOSION OF SEPTEMBER 29, 1969. Schelenz, R. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp 31-41 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs-und Informationsdienst e. V. (1974)). (In German)

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The radioisotopes ^{137}Cs, $^{141}Ce/^{144}Ce$, ^{103}Ru, $^{106}Ru/^{106}Rh$, and $^{95}Zr/^{95}Nb$ were measured in fallout in Germany after the Chinese nuclear explosion in order to answer the following questions: at what time after the explosion can an increase of the radioactivity of plants be detected, when is the maximum of the concentration of individual radionuclides reached and how large is the sum of the activities of these nuclides, and can the time dependence of the activity increase and decrease of individual nuclides be determined. The methods used for sampling, measurement, and evaluation of kale and spinach are described. The results are tabulated and indicate that the activities measured in large geographic regions differ markedly from each other. (JSR)

17203 MONITORING OF THE RADIOACTIVITY OF MILK IN THE GERMAN FEDERAL REPUBLIC. Knopp, E.; Kraemer, R.; Wiechen, A. (Bundesanstalt fuer Milchforschung, Kiel). pp 58-76 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e. V. (1974)). (In German)

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The significance of milk for monitoring the environmental radioactivity and the monitoring methods used in Germany are briefly summarized. The route by which radioactive materials accumulate in milk and precautions to be taken to avoid its contamination are discussed. Typical results obtained in the monitoring of milk since 1961 for ^{131}I, $^{140}Ba/^{140}La$, ^{89}Sr, ^{90}Sr, and ^{137}Cs are shown graphically and the probable future pattern of milk contamination is considered. (JSR)

17204 NUCLEAR EXPLOSIONS AND MARINE RADIOBIOLOGY. Feldt, W. (Bundesforschungsanstalt fuer Fischerei, Hamburg). pp 77-94 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e. V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The radiochemical properties of radioisotopes produced by underwater nuclear explosions and their radiobiological effects are reviewed. Biological half-lives of ^{137}Cs and ^{134}Cs, reported in the literature, are summarized. Experimental measurements of Fe, Zn, Cu, Mn, and Co concentrations in plankton of the sea surface and the pelagial and benthal zones are reported. Detection of ^{90}Sr, ^{137}Cs, and ^{90}Y in plankton is also reported. On the basis of these results and on literature data discussed, a model is derived for the reverse vertical transport of deep-sea sediment to the surface. (JSR)

17205 RADIOECOLOGY OF COASTAL AND INLAND WATERS. Feldt, W. (Bundesforschungsanstalt fuer Fischerei, Hamburg). pp 112-130 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e. V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The dependence of the ^{90}Sr and ^{137}Cs uptake on the Ca and K content of the water was studied in flounders, which live both in fresh and salt water. The ^{90}Sr contamination decreases with increasing Ca content in the waters. The dependence of the ^{137}uptake on the K content is not as clear as that of ^{90}Sr since in the uptake of Cs the food of the fish plays a larger role than in Ca. Concentration factors in fresh water, fish, pontweed, and mussel for Fe, Mn, Cu, and Zn are determined. The uptake of various radioisotopes through the sediment is decussed on the basis of published data. The radiation dose given by ^{90}Sr and ^{137}Cs under normal conditions were calculated. Fresh water fish receive an additional radiation dose equal to that of the natural radiation burden. (JSR)

17206 BEHAVIOR OF RADIONUCLIDES ON SURFACE-CONTAMINATED DRIED MEAT. Mirna, A. (Bundesanstalt fuer Fleischforschung, Kulmbach, Ger.). pp 131-135 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e. V. (1974)). (In German)

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The behavior of ^{137}Cs, ^{85}Sr, $^{144}Ce/^{144}Pr$, and $^{95}Zr/^{95}Nb$ in long duration surface contamination of raw sausage of beef, pork, and fat encased in cattle gut was studied. The results showed that the cattle gut provides a relatively good protection against the penetration of $^{144}Ce/^{144}Pr$ and $^{95}Zr/^{95}Nb$ and to a lesser extent against ^{85}Sr. ^{137}Cs penetrates the cattle gut within several days. The cattle gut is relatively easily decontaminated by rinsing with tap water except in the case of ^{137}Cs. (JSR)

17207 SIGNIFICANCE OF FOOD CONTAMINATION IN A CRISIS. Diehl, J. F. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp 325-336 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs-und Informationsdienst e. V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The food contamination that can be expected from nuclear warfare is considered. It is concluded that the only fission product that can seriously contaminate food is ^{131}I. The other fission products are only slightly soluble and can usually be removed by washing or peeling. (JSR)

Radiometric Techniques

Refer also to abstract 16797.

17208 (AECL-5103) TEMPORAL VARIATIONS IN THE PHOSPHORUS CONTENT OF A NORTHERN DYSTROPHIC LAKE. McMahon, J. W.; Docherty, A. E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1975. 17p. Dep. NTIS (US Sales Only) $4.00. AECL $0.50.

Concentrations of total and soluble phosphorus entering a small dystrophic lake via streams, their subsequent distribution in the whole lake and losses through the outlet were determined over the summer period when phosphorus in the epilimnion is regarded as being in a pseudo-steady state. Results, however, indicate significant increases with time of both total phosphorus and total soluble phosphorus at all depths in the lake during the study. Phosphorus input via streams is related to precipitation. More than one-half of the total soluble phosphorus entering the lake was retained in the lake. Contribution of soluble phosphorus to the epilimnion via stream input is regarded as a factor influencing observed changes in specific activity of ^{32}P in radiotracer experiments designed to study the cycling of phosphorus in lakes over an extended period of time. Observed losses of phosphorus from anaerobic sediments, accompanied by substantial increases in phosphorus content of overlying hypolimnetic waters, are discussed in terms of vertical entrainment or upwelling of nutrients. (auth)

17209 PHYSICS AND ARCHAEOLOGY. Aitken, M. J. Oxford; Clarendon Press (1974). 291p.

The following subjects are covered in separate chapters: dating; radiocarbon dating; thermoluminescent dating; archaeomagnetism; location of buried remains; magnetic prospecting; magnetometers; electrical resistivity surveying. The two chapters on radiocarbon dating and thermoluminescent dating are in NSA scope and separate abstracts have been prepared for them. (UK)

For abstracts of individual chapters see: 17210 and 17211.

17210 RADIOCARBON DATING. Aitken, M. J. pp 26-84 of Physics and Archaeology. Aitken, M. J. (ed.). Oxford; Clarendon Press (1974).

The subject is reviewed under the following headings: introduction (systematic errors, calibration, publication and availability); production of radiocarbon (variation with height, latitude and time); radioactive decay (radioactive equilibrium); the carbon exchange reservoir (concentration variations); measurement (treatment of different materials, different measurement techniques); recent fluctuations in radiocarbon concentration (fossil-fuel effect, effect of nuclear weapons testing, sunspot activity); concentration variations—causes (geomagnetic field intensity, geomagnetic reversals, solar activity, effect of climate, effect of lightning); conversion of radiocarbon dates to calendar dates. (UK)

17211 THERMOLUMINESCENT DATING. Aitken, M. J. pp 85-134 of Physics and Archaeology. Aitken, M. J. (ed.). Oxford; Clarendon Press (1974).

The subject is reviewed under the following headings: introduction; thermoluminescence (mechanism of TL); measurement (sample preparation, different measurement techniques); sample radioactivity (techniques, dose rate, chemical analysis, the archaeological context); archaeological application (assessment of error limits, tests); authenticity testing of ceramic art objects; TL per rad; pre-dose dating; materials other than pottery. (UK)

17212 SCREENING COMPOUNDS FOR EARLY WARNINGS ABOUT ENVIRONMENTAL POLLUTION. Metcalf, R. L. (Univ. of Illinois, Urbana). pp 213-217 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

A laboratory model ecosystem with a terrestrial-aquatic interface has been used to evaluate the potential environmental effects of nearly 100 micropollutants including insecticides, fungicides, plasticizers, heat transfer agents, flame retardants, pharmaceuticals, industrial chemicals and heavy metals. These have been evaluated largely by radiotracer techniques but atomic absorption spectrometry has also been used. Emphasis has been placed upon degradation pathways in a variety of organisms and upon quantitative data on biodegradation and bioaccumulation. The laboratory model ecosystem has substantial value as an environmental early warning element in evaluating the pollutant potential of various chemicals which may enter into the environment in trace amounts either purposely in various use patterns or accidentally from effluents of manufacture or waste products. (auth)

17213 CESIUM KINETICS IN A MONTANE LAKE ECOSYSTEM. Hakonson, T. E.; Whicker, F. W. (Colorado State Univ., Fort Collins). Health Phys.; 28: No. 6, 699-706(Jun 1975).

The kinetics of cesium transport in East Twin Lake, a 5-ha, natural semi-drainage lake which lies at an elevation of 2880 m in the north-central Colorado Rockies were determined. One kilogram of ^{133}Cs (as $^{133}CsCl$) was introduced into the water of East Twin Lake. Samples of water, seston, sediment, amphipods, zooplankton, trout and two species of vegetation were obtained over a 393-day period following the dosing event. Stable cesium was measured by neutron activation analysis. (auth)

17214 SEDIMENTATION RATES IN A LONG ISLAND MARSH DETERMINED BY ^{210}Pb DATING. Armentano, T. V.; Woodwell, G. M. (Brookhaven National Lab., Upton, NY). Limnol. Oceanogr.; 20: No. 3, 452-456(May 1975).

Mean rates of vertical accretion of from 0.47 to 0.63 cm yr^{-1} have been determined for the past century from two widely separated sites at Flax Pond, a Spartina alterniflora marsh on the north shore of Long Island. Sediments were dated from ^{210}Pb activity. The rates are equivalent to deposition of 325 to 436 g of dry organic matter m^{-2} yr^{-1} or about 146 to 196 g of carbon m^{-2} yr^{-1}. Although the two sites differed in salt peat thickness, the basal layer of the peat was deposited about 100 years ago at both. (auth)

17215 DATING A STALACTITE BY ELECTRON PARAMAGNETIC RESONANCE. Ikeya, M. (Yamaguchi Univ., Ube, Japan). Nature (London).; 225: No. 5503, 48-50(1 May 1975).

Some studies are reported on stalactites of Japan's main calcite caverns. The presence of a radioinduced defect is reported and it is shown that estimation of the accumulated defect concentration at several positions, using the EPR technique, makes it possible to determine the age and growth rate of the stalactite. The most plausible explanation for the presence of the radioinduced defect is natural radiation by cosmic rays and from radioactive elements such as ^{40}K, ^{238}U, and ^{232}Th. (UK)

17216 LIST OF SAMPLES DATED BY THE RADIOCARBON METHOD AT THE INSTITUTE OF GEOLOGY OF THE ACADEMY OF SCIENCES OF THE ESTONIAN SSR. II. Punning, Ya. M.; Kakum, T.; Rayamyae, R. (Inst. of Geology, Tallin, USSR). Izv. Akad. Nauk Est. SSR, Khim. Geol.; 4: No. 2, 160-165(1975). (In Russian).

The list given includes ^{14}C dates calculated at the Institute of Geology of the Academy of Sciences of the Estonian SSR in 1973. All radiocarbon dates are calculated (from the year 1950) with ^{14}C half-life of 5568 ± 30 years. (auth)

17217 UNRELIABLE ^{14}C DATING OF LONG-STORED DEEP-SEA SEDIMENTS DUE TO BACTERIAL ACTIVITY. Geyh, M. A. (Geological Survey, Hanover); Kudrass, H. R.; Krumbein, W. E. Mar. Geol.; 17: No. 2, M45-M50(Sep 1974).

Unreliability of radiocarbon ages obtained on the organic-carbon fraction of marine sediments stored wet and over a long period is explained as a consequence of bacterial uptake of recent CO_2. Deep-freezing, drying, or immediate processing of samples intended for ^{14}C age determination is recommended. (auth)

17218 DETERMINATION OF THE TIME OF RESIDENCE OF HUMIC FRACTIONS OF TWO FERALLITIC SOILS USING NATURAL AND THERMONUCLEAR RADIOCARBON. Lobo, P. F. S. (Univ. Federal da Bahia, Salvador, Brazil); Flexor, J. M.; Rapaire, J. L.; Sieffermann, G. Cah. ORSTOM, Ser. Pedol.; 12: No. 1, 115-123(1974). (In French).

From 4th Latin-American congress on soil science; Maracay, Venezuela (12 Sep 1972).

Two profiles of ferallitic soils from the state of Bahia (Brazil) were studied. The isotopic relations $^{14}C/^{12}C$ of about fifteen samples were determined for the fulvic and humic fractions and humin extracts, according to the method of Dabin. The results were interpreted according to a mathematic model formerly formulated. They showed the following conclusions: the average time of residence for fulvic acids, humic acids, and humins is about one hundred years. More than 90% of the mineralized carbon comes from near-surface areas less than 30 to 60 cm deep. From all the fractions studied, the humin shows, on the surface, the shortest time of residence. On the contrary, at greater depth the time of residence is the longest. It was attempted to determine the migration speed of the fulvic and humic acids. (auth)

17219 K–Ar AGES OF SOME ORE DEPOSITS IN JAPAN. Yamaoka, K.; Ueda, Y. (Tohoku Univ., Sendai (Japan). Faculty of Science). Kozan Chishitsu; 24: No. 4, 291-296(Aug 1974). (In Japanese).

The K–Ar ages of the minerals from several ore deposits in Japan were determined as follows: Adularia from the Au–Ag-quartz vein of the Seikoshi mine, Shizuoka Prefecture: 3.7 m.y.; Adularia from the Au–Ag-quartz vein of the Takatama mine, Fukushima Prefecture: 8.4 m.y.; Adularia from the Cu-quartz vein of the Ani mine, Akita Prefecture: 11 m.y.; Orthoclase from the Ag-quartz vein of the Omidani mine, Hyogo Prefecture: 66 to 68 m.y.; Orthoclase and muscovite from the W–Sn–Cu-quartz vein of Kaneuchi mine, Kyoto Prefecture: 73 m.y. and 93 m.y., respectively. The ages of the mineralization of the Takatama and Seikoshi mines are considered to be the Pliocene and the late Miocene, respectively. The K–Ar age of adularia from the Ani mine is similar to that of orthoclase and biotite of the Taishoko granitic rock where the major ore veins occur. The vein-type deposits of this mine are probably related to granitic intrusion of the middle Miocene. The K–Ar age of the Omidani ore deposits is similar to that of the Ikuno and Akenobe xenothermal-type ore deposits. From the K–Ar dating as well as the zonal distribution of hypogene minerals, the Omidani silver deposits are thought to constitute an outer zone of the Ikuno-Akuno metalliferous district. The mineralization seems to be a part of the late Cretaceous to Paleogene granitic activities. The muscovite age of the tungsten deposits of the Kaneuchi mine belonging to the hypothermal or pegmatitic vein-type coincides with the isotopic ages of the granodiorite where the Otani tungsten deposits occur. It is inferred that the deposits of the Kaneuchi mine are genetically related to the late Cretaceous granitic activities. (auth)

Site Surveys

Refer also to abstracts 17184 and 17227.

17220 (ANL/RER-75-2) OBSERVATIONS OF ATMOSPHERIC STRUCTURE USING AN ACOUSTIC SOUNDER. Shaw, N. A. (Argonne National Lab., Ill, (USA)). Nov 1974. Contract W-31-109-Eng-38. Dep. NTIS $5.00.

An acoustic sounder has been used to monitor the vertical temperature structure of the lowest 1.5 km of the atmosphere over the meteorological field site at Argonne National Laboratory since February 1972. Additional records were obtained near St. Louis, Mo., during the month of August. Sounder records obtained during cloudless days on which no major synoptic events occurred are separated into three characteristic phases. The first phase is the rise of the morning inversion associated with increasing solar heating of the surface after dawn. The second phase is the period of strong convective activity that usually exists between about 1100 and 1600 local time in summer and which typically destroys the inversion. The third phase includes the gradual regeneration of the low level inversion through radiation cooling of the lowest levels, followed by a period of persistence throughout the night until the first phase begins again after sunrise. Analysis of records obtained from a single acoustic sounder operating in the vertically pointing, monostatic mode is subject to the usual ambiguity regarding the relative importance of advective effects and local

changes with time. To provide a spatial sampling facility, a mobile acoustic sounding system was constructed during 1972. Details of the mobile antenna acoustic baffle or cuff are given in the Appendix. (19 figures, 1 table) (auth)

17221 (BNWL-1950(Pt. 4), pp 83-84) DEVELOPMENT OF A METHODOLOGY FOR THE ASSESSMENT OF SOCIAL VALUES. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

The objective of this project is to develop a technique for the combination of techno-economic data with social values for decision-making concerning design and siting options for nuclear power plants. Specifically, quantified technical information is weighted by social values and subsequently summed to differentiate among alternatives. The current phase of the project is designed to test the feasibility of such a technique in a community already experienced with a nuclear power plant. The ultimate objective is to develop a standard procedure for inputting community values into the decision matrix prior to a final site/design selection. (auth)

17222 (PRNC-182) PUNTA MANATI ENVIRONMENTAL STUDIES. Wood, E. D.; Youngbluth, M. J.; Nutt, M. E.; Yeaman, M. N.; Yoshioka, P.; Canoy, M. J. (Puerto Rico Nuclear Center, Mayaguez). 15 Apr 1975. Contract AT(40-1)-1838. 229p. Dep. NTIS $14.50.

Results are reported from a survey of the Punta Manati area on the north coast of Puerto Rico to determine the practicability of locating a power generating plant at the site. The geological features of the site are described. Data are presented on tides and currents; seasonal variations in water temperature, density, and salinity; the variety and biomass of zooplankton, benthic invertebrates, and fishes in the coastal waters; and plant associations of the coastal area. (CH)

17223 (PRNC-183) PUNTA HIGUERO ENVIRONMENTAL STUDIES. Wood, E. D.; Youngbluth, M. J.; Nutt, M. E.; Yeaman, M. N.; Yoshioka, P.; Canoy, M. J. (Puerto Rico Nuclear Center, Mayaguez). 1 May 1975. Contract AT(40-1)-1833. 185p. Dep. NTIS $12.25.

Site selection surveys and environmental research studies of seven coastal sites in Puerto Rico for construction of power generating facilities were carried out. Data are presented on the physical, chemical, and geological parameters of the Punta Higuero site, and the ecological parameters of zooplankton, benthic invertebrates, and fish communities. Plant associations are included. (auth)

17224 (TVA-TR-74-1) GENERATION OF MISSILES BY TORNADOES. (Tennessee Valley Authority, Chattanooga (USA)). Nov 1974. 73p. Tennessee Valley Authority, Chattanooga, TN.

Available data on tornado wind velocities and wind distribution are incorporated into a mathematical model of the tornado wind field. The mathematical model is then used to predict the time-history of motion of a potential missile in a tornado wind field. (MCG)

17225 ENVIRONMENTAL MONITORING THROUGH THE USE OF EXPOSURE PANELS. Hillman, R. E. (William F. Clapp Labs., Inc., Duxbury, MA). pp 55-76 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

Exposure panels made of white pine with a transite facing are useful for assessing population and community changes in both polluted and unpolluted waters. Their uniform size and shape and the ease with which they can be handled makes them ideal for sampling a wide variety of sessile plants and animals, and those motile forms usually associated with sessile communities. Data from an ecological study at Millstone Point are used as examples of the kinds of information provided through the use of exposure panels as environmental monitors. Species diversity indexes for both algal and annelid populations as they occurred on panels from 1968 through 1973 were calculated. Regression analyses over time showed increases in diversity indexes since the program began, indicating possible changes in water quality. For the period of October 1971 through September 1972, the number of phyla found on panels exposed at Millstone Point, New Haven Harbor, and Stamford Harbor were not significantly different, but far more species were found on the Millstone Point panels. (auth)

Thermal Effluents

Refer also to abstract 17184.

17226 (ORO-3801-7) PROGRESS REPORT, 1 JULY 1974–30 JUNE 1975. (Miami Univ., Fla. (USA). Rosenstiel School of Marine and Atmospheric Sciences). 1975. Contract AT(40-1)-3801. 304p. Dep. NTIS $18.25.

Results are reported from field studies on the effects of thermal additions from the Turkey Point nuclear power plant discharge on the macro-invertebrates and fishes of this area of Biscayne Bay. Replicate samples with a 3 m (10 foot) otter trawl lined with .63 mm (4 in.) bar mesh were made monthly at 51 stations. Data on temperature, salinity, and oxygen were collected during each sampling period. Additional chemical data were collected when opportunity existed. The experimental results suggest that maximum summer temperatures below 32°C cause detrimental changes in the environment which are reversible in the winter, while temperatures above 33°C cause damage which does not recover during the cooler months. Intermittent flow of discharge water is as damaging as constant flow. Card Sound was occupied by a sponge-brittle star community but many organisms were common to both the Sound and Biscayne Bay. The discharge to Card Sound lasted about one year and temperatures in excess of 33°C were uncommon. Only a few indicator species showed stress and higher apparent abundance of others offset their decrease. Generally no lasting damage occurred in Card Sound. Recovery after closing Grand Canal was relatively complete 200 yards from the effluent. Data are also included from studies on leaf degeneration in mangrove swamps and the relationship of associated fungi in the decay of leaves of mangrove and other tropical shoreline trees. (CH)

17227 FISHERIES AND ENERGY PRODUCTION: A SYMPOSIUM. Conference Held at New Haven, Connecticut, February 24–26, 1975. Saila, S. B. (ed.). Lexington, MA; D. C. Health and Company (1975). 307p. (CONF-750223-).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975).

Separate abstracts were prepared for eight papers presented at the conference. (HLW)

For abstracts of individual papers see: 17225 and 17228–17234.

17228 SIMULATING THE IMPACT OF THE ENTRAINMENT OF WINTER FLOUNDER LARVAE. Hess, K. W.; Sissenwine, M. P.; Saila, S. B. (Univ. of Rhode Island, Kingston). pp 1-29 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

The transport of winter flounder larvae around the Millstone Point, Conn, area by the action of tidal currents and diffusion was simulated by computer to predict the numbers which could be entrained during the operation of a local nuclear power station. A tidal hydrodynamic model with variable depth was employed to simulate currents and water levels. These techniques provided input to a transport model which simulated the concentration of larvae. A larval source in a tributary river was simulated for twenty tidal cycles, with and without entrainment. The results indicated that the reduction in winter flounder larvae near Millstone Point at the end of the pelagic stage (period during which larvae are likely to be entrained) was less than 1 percent when it was assumed that larvae have little chance of returning once lost from Millstone bight. In order to assess the effect of a 1 percent reduction in recruitment of winter flounder larvae to the benthic phase of their life cycle, the local population was simulated by a model in which year-classes and the total egg production were represented by compartments. Each year-class grew, produced eggs, suffered natural and fishing mortality according to information derived from the literature. The effect of power plant entrainment was incorporated by reducing the number of recruits to year-class I that would normally result from a specific level of egg production. For a 1 percent reduction in recruitment due to power plant entrainment, a potential 6 percent decrease in total population size following 35 years of operation was indicated. (auth)

17229 SOME COMMENTS ON THE THERMAL EFFECTS OF POWER PLANTS ON FISH EGGS AND LARVAE. Schubel, J. R. (State Univ. of New York, Stony Brook). pp 31-54 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

Fish eggs and larvae entrained by steam electric stations with once-through cooling systems are exposed to an initial rapid rise in temperature approximately equivalent to the temperature rise across the condensers. They are exposed to the maximum DELTA T during passage through the plant and to the point of discharge and then to decreasing excess temperatures (i.e., temperatures above those to which they have been acclimated)

as they are carried down the plume. The actual time-temperature exposure histories depend primarily upon plant design and the characteristics of the receiving waters. Site studies have failed to establish unequivocally the cumulative effects of the several stresses experienced by entrained fish eggs and larvae, and separation of the individual effects of these stresses has rarely, if ever, been possible. Most laboratory studies of the thermal requirements of fish eggs and larvae are also of little use in predicting the thermal effects of entrainment because of the inappropriateness of the time-temperature histories. The few laboratory studies of fish eggs and larvae that have been specifically directed at entrainment questions have shown clearly that the thermal effects of entrainment can be assessed in the laboratory. These few data are reviewed. Blueback herring, alewife, American shad, and striped bass eggs were able to survive exposure to typical time-excess temperature histories with DELTA T's of at least 10°C above the average temperature on the spawning grounds without any harmful effects. Larvae were generally able to withstand exposure to DELTA T's of 12°C above acclimation temperatures of 5° to 15°C for at least 40 minutes without any significant increases in mortality. At higher excess temperatures, acclimation temperature and duration of exposure became increasingly more important. (auth)

17230 MECHANICAL EFFECTS OF WATER FLOW ON FISH EGGS AND LARVAE. Ulanowicz, R. E. (Univ. of Maryland, Salomons). pp 77-87 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

The impact of mechanical stresses on ichthyoplankton entrained in power plant cooling systems has long been considered negligible. Arguments and evidence exist, however, to show that such a supposition is not universally true, especially in nuclear power plants. The mechanisms of mechanical damage can be detailed in terms of pressure change, acceleration, and shear stress within the fluid flow field. (auth)

17231 ENTRAINMENT OF ORGANISMS AT POWER PLANTS, WITH EMPHASIS ON FISHES: AN OVERVIEW. Marcy, B. C. Jr. (NUS Corp., Pittsburgh). pp 90-106 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

An overview of the recent information available on entrainment, specifically on fish eggs and larvae, is presented. The components of inner-plant mortality (thermal, mechanical and biocidal effects) are discussed, with emphasis on recent data on mechanical damage. Sampling considerations for entrainment studies as well as philosophies and suggestions for reducing entrainmen losses are presented. Power plant impact can be minimized by siting in non-productive areas and going to closed cooling systems, i.e., lower intake volumes, since the mortality of meroplankton is directly related to the volume entering the intake. The low volume concept is presently the only effective approach to minimizing the adverse effects on entrained organisms. If studies continue to reveal high percentages of mechanical damage relative to thermal or chemical effects, future alternative strategies may also include the raising of condenser DELTA T's while lowering the intake water volume, i.e., decreasing the number of entrained organisms vulnerable to mortality. (auth)

17232 ASSESSMENT OF IMPACT DUE TO ENTRAINMENT OF ICHTHYOPLANKTON. Horst, T. J. (Stone and Webster Engineering Corp., Boston). pp 107-118 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

Three approaches to the assessment of impact associated with the entrainment of ichthyoplankton into power stations are discussed. The first is the estimation of the probability of mortality for those organisms entrained. The second is the assessment to the fish populations which have the egg and larvae life stages entrained. The third approach is the assessment of impact to the community or ecosystem. Some models are presented as examples for each of the three approaches. (auth)

17233 LABORATORY AND FIELD TEMPERATURE PREFERENCE AND AVOIDANCE DATA OF FISH RELATED TO THE ESTABLISHMENT OF STANDARDS. Stauffer, J. R.; Cherry, D. S.; Dickson, K. L.; Cairns, J. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg). pp 119-139 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

Temperature preferences for important fish species in the New River in the vicinity of Appalachian Power Company's Glen Lyn, Virginia plant were determined independently by both field and laboratory studies. A relationship was demonstrated between the temperature preference data generated by the two approaches. Based on the temperature preference data the responses of fish to the thermal discharges can be predicted. From these data and from other data on the fish community structure, it was possible to determine that the thermal discharge was causing no appreciable harm to the fish community. Based on these studies it was concluded that the most reasonable approach to establishing thermal standards is to couple temperature preference studies with site specific studies. (auth)

17234 EFFECTS OF TWO ELECTRICAL BARRIERS ON THE ENTRAINMENT OF FISH AT A FRESHWATER NUCLEAR POWER PLANT. Hyman, M. A. M.; Mowbray, W. H. (Univ. of Rhode Island, Kingston). pp 205-237 of Fisheries and Energy Production. Saila, S. B. (ed.). Lexington, MA; D. C. Heath and Co. (1975).

From fisheries and energy production symposium; New Haven, Connecticut, USA (24 Feb 1975). See CONF-750223-.

In order to limit the numbers of fish entrained at the Connecticut Yankee Atomic Power Plant (CYAP) at Haddam Neck, Connecticut, it was desirable that a system be designed to discourage the presence of fish from the immediate environs of the plant intakes. Two such systems are described, both of which statistically reduced the numbers of fish taken. The feasibility of electrical barriers for reducing power plant entrainment in a freshwater environment was demonstrated. (auth)

17235 TEMPERATURE OPTIMUM OF ALGAE LIVING IN THE OUTFALL OF A POWER PLANT ON LAKE MONONA. Brock, T. D.; Hoffmann, J. (Univ. of Wisconsin, Madison). Trans. Wis. Acad. Sci., Arts Lett.; 62: 195-203(1974).

Temperature optima for photosynthesis were measured for algal populations living in the outfall of a fossil-fuel electric power plant on Lake Monona and were compared with the temperature optima of algae living in a control area in the nearby Yahara River. The temperature of the power plant outfall averaged about 8°C higher than that of the Yahara River. In the winter, no differences in species composition between the two study areas could be detected, Cladophora and Ulothrix being the dominant algae. The temperature optima of the populations from the two locations were the same, around 27°C, although the habitat temperatures at both locations were considerably lower. The only difference in response to temperature seen between the two populations was that the population at the outfall was able to photosynthesize at higher temperature, still showing high photosynthesis at 35°C and detectable photosynthesis at 46°C, a temperature at which the population from the Yahara River showed no detectable photosynthesis. In the summer, the dominant algae at the power plant outfall were Stigeoclonium and filamentous blue-green algae (family Oscillatoriaceae), whereas at the Yahara River the algal population was almost exclusively Cladophora. The temperature optima of both summer populations were the same, 31,5°C, only slightly higher than the mid-winter optima. Again, the population from the power plant was able to photosynthesize at higher temperature than the control population, showing quite active photosynthesis at 42,5°C, a temperature at which the population from the Yahara River was completely inactive. (auth)

17236 ANALYSIS OF SURFACE SLICKS IN A RESERVOIR RECEIVING HEATED EFFLUENT. Lewis, W. M. Jr. (Univ. of Colorado, Boulder). Contract AT(38-1)-310. Arch. Hydrobiol.; 74: No. 3, 314-315(Nov 1974).

Large elongate surface slicks are frequently observed on Par Pond, a South Carolina reservoir receiving waste heat. One or more slicks between 50 and 2000 m long and 1 to 50 m wide can be seen on almost any day during the stratification period when the wind strength is between 0,5 and 5,0 m sec^{-1}. Slicks are oriented approximately parallel to the wind and accumulate suspended fragments of macrophytes below the surface as well as debris and organic matter on the surface. An experiment with the surface film indicates that substantially greater amounts of organic compounds are present on the water surface within slicks than outside slicks. Thermal cross section maps demonstrate that slicks are always located above abrupt horizontal temperature discontinuities that ordinarily range between 0,10 and 0,20°C. Wind driven currents of 4 to 10 cm sec^{-1} converge along the long axis of the slicks and provide the basis for an explanation of the slick phenomenon. Slicks of a similar nature can reasonably be expected on other thermally-altered lakes. (auth)

17237 THERMAL ALTERATION OF AQUATIC ECOSYSTEMS. Gibbons, J. W.; Sharitz, R. R. (Univ. of Georgia, Athens). Am. Sci.; 62: No. 6, 660-670(1974).

The studies summarized emphasize that heated effluents may function to enrich or to stress an ecosystem, depending upon the biological feature examined. However, the potential for negative impact on aquatic environments must not be underestimated. The ultimate consequences of the sometimes drastic alteration of behavior patterns and life-history phenomena in the surviving inhabitants of thermal areas have yet to be assessed. The relatively short time span of thermal field studies has not allowed thorough understanding of the biological chain reactions that may take place as physiological and genetic adjustments are made. Ensuing changes in species interactions, practically uninvestigated at this time, may create heretofore unsuspected ecosystem changes. Man's challenge for the future is to gain a more thorough comprehension of thermal ecology and to determine how waste heat may be used as an energy subsidy rather than a stress to aquatic systems. These and subsequent studies may assist in understanding how natural ecosystems respond to temperature elevation and will lead to the development of concepts and principles pertaining to thermally altered environmental systems. (auth)

17238 SOME THERMAL EFFECTS OF A SIMULATED ENTRAINMENT REGIME ON MARINE PLANKTON. Crippen, R. W. Orono, ME; Univ. of Maine (1974). 113p. University Microfilms Order No. 75-12,414.

Thesis (Ph. D.).

Six species of diatoms, various life stages of seven species of zooplankters, and the demersal eggs of a fish were subjected to laboratory simulations of the maximum thermal regime predicted for the Maine Yankee Atomic Power Plant. Each organism was tested from the ambient temperature(s) (AT) at which they occurred normally. These ranged from 3 to 20°C. The simulated thermal regime (STR) consisted of a nearly instantaneous temperature rise (usually 14°C) above AT followed by a controlled return to AT over a 3-hr period. Chaetoceros laciniosus, which suffered a complete mortality, was the only diatom species sensitive to the STR from a 3 to 15 C AT. Chaetoceros lorenzianus and Skeletonema costatum, not sensitive to the STR from an AT of 15°C, were sensitive from an AT of 20°C; although mortalities were not complete, the lag phase preceding exponential growth in treated cultures was usually prolonged. The zooplankters and fish eggs tested from AT's of 3, 5, or 10°C were not sensitive to the STR. However, zoea of the decapod crab Cancer irroratus, not sensitive to the STR from a 10°C AT, were sensitive from a 15°C AT. The data suggested that other factors, including crowding, salinity, and duration of exposure, may have complicated the zoea results at the 15°C AT. Nauplii of the calanoid copepod, Eurytemora herdmani were all killed when tested from a 20°C AT, but not from a 10°C AT. Females of the archiannelid, Dinophilus conklini were tested from an AT of 20°C with inconclusive results, which suggested these organisms may be sensitive to the STR from this AT. Polychaete nectochaetes and juveniles, the most tolerant group tested, showed no sensitivity to the STR from AT's ranging from 3 to 20°C. (Diss. Abstr. Int., B)

17239 EFFECTS OF THERMAL DISCHARGES ON THE MICROSTRUCTURAL GROWTH OF MERCENARIA MERCENARIA. Kennish, M. J.; Olsson, R. K. (Rutgers–the State Univ., Brunswick, NJ). Environ. Geol.; 1: No. 1, 41-64(1975).

The effects of thermal discharges from the Oyster Creek Nuclear Generating Station at Barnegat Bay, New Jersey, are recorded in the microstructural growth of Mercenaria mercenaria, a common coastal marine pelecypod. The analysis of the shell microstructure shows that this bivalve acts as an effective monitor of the environmental conditions existing in the marine waters adjacent to the power station. Many physiological and environmental events such as spawning, winter (freeze) shocks, summer (heat) shocks, thermal shocks, tidal cycles, and major storms are clearly recorded in the shell microstructure. The exact time of occurrence of these events can be determined by counting daily growth increments backwards from the outer shell margins of freshly killed individuals. (auth)

Chemical Effluents

Refer also to abstracts 16729 and 17187.

17240 (BNWL-1950(Pt. 4), pp 24-32) ENVIRONMENTAL POLLUTION ANALYSIS. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

To understand the physical and chemical behavior of inorganic and organic pollutants in the environment, it is essential that techniques be developed to sample and measure pollutants at their source, during their transport, and throughout the environment. To meet some of these needs: a method was developed for the in situ analysis of trace element pollutants in sediments by x-ray fluorescence which can measure up to 30 elements at the 20 to 50 ppm levels; plasma excitation techniques were developed for chemical species determination of As and Sb; sampling methods and gas chromatograph techniques were developed for inorganic and organic gases; and feasibility studies have been made of continuous injection mass spectrometry and laser excitation analysis of isotopic trace elements and molecules at levels of 5 to 10 orders of magnitude improvement. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstracts 16756, 16892, 17185, 17189, 17194, 17196, 17592, and 17890.

17241 APPARATUS FOR STUDYING THE "CHANNELING" EFFECT OF FAST CHARGED PARTICLES. Dzhazairov-Kakhramanov, V.; Ibragimov, Sh. Sh. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 23-29(1974). (In Russian).

Experimental apparatus is described for studying radiation effects using "channeling" and blocking effects of charged particles on monocrystals. With this apparatus experiments can be made on 20- by 20- by 5 samples from −196 to 500°C at 1×10^{-6} mm Hg. The samples are oriented relative to the incident beam by a goniometric head located in the center of the vacuum chamber. Experimental results are presented on the angular and energy distribution of back-scattered protons around the [111] axis of the monocrystal of the form of a "shadow" of 4-MeV protons around the [111] axis as a function of the thickness of a tungsten monocrystal. (4 figures) (tr-auth)

General Detectors and Monitors

Refer also to abstracts 17401, 17565, 17566, and 18533.

17242 (CONF-740807-P2, pp 863-875) CONTINUOUS MONITORING OF RADIOACTIVE IODINE EMISSIONS. Wilhelm, J. G. (Nuclear Research Center, Karlsruhe, Ger.); Mahnau, H. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab).

The detection of ^{131}I in atmospheric concentrations down to 2×10^{-9} Ci/m^3 and even less, which may be necessary in health physics, calls for a specific measurement technique. A monitor has been developed for the continuous measurement of the ^{131}I-content of air in which iodine is accumulated on a special filter cartridge. The ^{131}I-activity is measured continuously by detection during the accumulation process and displayed on a ratemeter. An alarm may be given if a certain level of the total accumulated iodine activity (A) is reached in the filter cartridge (integral method) or a preset ratio of dA/dt is exceeded (differential method). Elemental iodine and methyl iodide can be measured with the same detection sensitivity even in air of extremely high humidity. The influence of rare gas activity on the measurement is low due to the use of an inorganic iodine sorption material. The construction principles of the continuous iodine monitor are discussed. Data are given on the length of the sampling period preceding the alarm, for two different versions of the monitor, the detection limit and the selectivity of ^{131}I-measurement in off-gas which might also contain radioactive rare gases. (auth)

17243 (CONF-740807-P2, pp 876-889) CONTINUOUS MONITORING OF NOBLE GASES IN REACTOR STACK EXHAUST. Wood, M. B.; Randolph, H. W. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A system at the Savannah River Plant continuously monitors radioactive noble gases (^{41}Ar, ^{133}Xe, ^{135}Xe, /sup 85m/Kr, ^{87}Kr, ^{88}Kr) discharged to exhaust stacks from each of three heavy-water moderated reactors. A description of the system, calibration technique, and early operating experience are discussed. A flowing sample of stack exhaust air, passing through a 2.8-liter stainless steel sample cell, is monitored for noble gases by a lithium-drifted germanium, Ge(Li), detector coupled to a multichannel analyzer. Isotopes of noble gases are counted and release data are updated each ten minutes by teletype printout. The system is calibrated by determining the counting efficiency vs gamma energy relationship for both the detector and the sample cell. These relationships are determined with International Atomic Energy Agency standard point sources, National Bureau of Standards ^{133}Xe and ^{85}Kr standard gas sources, and sources containing mixed radioactive noble gases. Accuracy of calibration for the absolute efficiency of the system is +- 15 percent at two standard deviations. Operating experience shows that the system functions reliably and provides useful data on release of radionuclides to the atmosphere. (auth)

17244 (CONF-740807-P2, pp 890-900) EMISSION MONITORING SYSTEMS FOR PLUTONIUM FACILITIES. Freiberg, K. J.; Haynes, C. G. (Dow Chemical U. S. A., Golden, CO). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The primary purposes of monitoring gaseous effluent are to insure that environmental discharges conform to specified guidelines and to evaluate the performance of the air cleaning system. A system, at a plutonium facility, is described whose important characteristics are: continuous monitoring with central readout of the amounts of radioactive and chemical pollutants; extensive fixed sample collection; and measurement of the total effluent volume. Also described is a technique for in-service contamination surveys of filter plenums. The system meets the requirements set forth in the "Minimum Design Requirements for New Plutonium Facilities." (auth)

17245 SENSITIVITY OF G-M AND ION CHAMBER BETA-GAMMA SURVEY INSTRUMENTS. Sommers, J. F. (Aerojet Nuclear Co., Idaho Falls, ID). Health Phys.; 28: No. 6, 755-761 (Jun 1975).

Development of a new generation of portable β-γ radiation survey instruments and application of the "as low as practicable" philosophy has presented a problem of compliance with guides for radioactive contamination control. Isolated, low-level, discrete particle β-γ contamination is being detected with the new instruments. In order to determine the limits of practicability, it is necessary to determine the limits of detection of these surface contaminants. The included data and calculations indicate typical source detection frequencies that can be expected using the new generation of survey instruments. It is concluded that about 5000 dis/min of β activity per particle, in low-density populations of discrete particles, is the minimum level of activity per particle that is applicable for confident compliance with surface contamination control guides. Lower control levels are possible with additional development of instruments or through high cost changes in radiation survey and contamination control methods. Additional analyses are required for assessment of the hazards caused by the widely dispersed, discrete particle contaminants. (auth)

17246 ABSOLUTE FLUENCE MEASUREMENT FOR A PROTOTYPE NEUTRON RADIOTHERAPY SOURCE. Beach, J.L.; McCullough, E.C. (Department of Radiology, University of Wisconsin, Madison, Wisconsin 53706). Med. Phys. 2: No. 4, 213-215 (July 1975).

An inexpensive recoil-proton counter telescope has been designed for absolute fluence measurements of a gas-target neutron source for radiation therapy. The detector has an absolute efficiency of 1.1×10^{-9} at 20 cm from an isotropic source and is useful for production rates of 10^9–10^{13} neutrons per second. The telescope consists of a thin hydrogenous irradiator foil and a surface-barrier detector to count recoil protons within a defined solid angle. The telescope provides n-γ discrimination as well as discrimination against scattered neutrons. Initial tests of the counter telescope were performed using the DD reaction employed in development stages of the gas target. A clear separation of full-energy recoil protons from background and scattered neutron events was evident in the pulse-height spectra without the use of coincidence gating techniques. (auth)

17247 NEW COCKTAIL FOR LIQUID SCINTILLATION COUNTING OF AQUEOUS RADIOIMMUNOASSAY SAMPLES. Wiegman, T.; Woldring, M. G.; Pratt, J. J. (Rijksuniversiteit, Groningen, Netherlands). Clin. Chim. Acta; 59: No. 3, 347-356(Mar 1975).

A new mixture for liquid scintillation counting, consisting of xylene, triton X-100 and mono- and dibutylphosphates is described. Plasma can be added up to 10% of the scintillator's volume. Good dissolving properties, high counting efficiency, absence of chemiluminescence and a good stability and reproductibility with respect to the disintegrations per minute were achieved. The cost was only 25% of the commercially available, ready-to-use liquid scintillation mixtures with which a comparison was made. (NL)

17248 NEUTRONIC FLUX MONITORS. Burnett, R. C.; Davies, T. A. British Patent 1,385,932/B/. 5 Mar 1975. 3p.

A neutron flux monitor is described that can be manufactured

in small sizes and that will maintain its integrity under prolonged irradiation exposure in a high temperature environment. It takes the form of a ceramic sphere doped with a metallic oxide and coated with pyrocarbon, with a finishing coat of SiC. The ceramic material is agglomerated Al_2O_3 powder and the metallic oxide is cobaltous oxide, nickel oxide, or ferric oxide. The manufacturing method is described. (UK)

17249 ISOCOUNT SCINTISCANNING SYSTEM. A Probability Theory Approach. Ikebe, J.; Nawa, O. A. (Tokyo Inst. of Tech. (Japan)). Bull. Tokyo Inst. Techno. (Engl. Ed.); No. 119, 1-13 (Sep 1973).

The scintiscanning is a technique widely employed in the Nuclear Medicine for detecting cancer and other lesions. This paper deals with scanning processes from the probability theory viewpoint. In order to evaluate the fidelity of the scintigram, the relative deviation $\epsilon(n) = \sigma(n)/E(n)$ is introduced; $\sigma(n)$ is the standard deviation and E(n) is the expectation of the imaging pulses n(t). It was confirmed experimentally that n(t) is a Poisson process, so that in the conventional constant speed brain scanning $\epsilon(n)$ may vary remarkably within the cold area, an important area for analysis. Based on the fact that the fidelity should be improved by maintaining the relative deviation constant, the isocount scanning was devised and realized. By this method, $\epsilon(R) = 1\sqrt{N}$, where N is a preset constant, becomes independent of the count rate R over all the observed plane. A contrast enhancing method by using conveniently the nonlinear characteristics of the film density curve and the possibility of negative imaging are also presented. This scanning method was applied with success to the brain. (auth)

17250 MARKING DEVICE OF GAMMA CAMERA. Manufacture of Scintiphoto Marker and its Clinical Application. Tatsuno, I. (National Hospital of Kanazawa (Japan)); Kato, S. Rinsho Hoshasen; 19: No. 10, 819-821(Oct 1974). (In Japanese).

A position averaging circuit for a gamma camera was designed and position marks could be recorded on the scintiphoto. This method has no defects, as shown in the direct photographic method of a γ-ray source. Clear marks with no vignette can be continuously recorded in order for a short time. This method seems to play an important role in clinical diagnosis. (JA)

17251 QUANTITATIVE ANALYSIS OF SCINTISCAN MATRICES BY COMPUTER. Kohno, H.; Suzuki, T. (Hitachi Ltd., Kokubunji, Tokyo (Japan). Central Research Lab.). Iyo Denshi To Seitai Kogaku; 12: No. 4, 218-225(Aug 1974). (In Japanese).

Quantitative data in relation to diagnostic information were obtained from scintiscan matrices by digital computer. The data from a scintillation scanner through punched tape were smoothed by the moving average method, and the perimeter of the thyroid was decided from a histogram of smoothed data and then counts were normalized from 0 to 10. The thyroid was divided into right and left lobes from the maximum and minimum points of curvature of the perimeter. About each lobe individually, features such as uptake of radioactive iodine, quantification of ^{131}I distribution, difference of ^{131}I distribution between right and left lobes, area of thyroid, ratio of the longest and the shortest diameters, and perimeter irregularity quantitated by circle fitting to the perimeter were extracted and by using decision tree combined with linear discriminant function, thyroid scintigrams were classified into eight categories. These categories are normal, hyperthyroidism, hot nodules, small defect in lobe, large defect of unilateral lobe, large defect of both lobes, complete defect of unilateral lobe and low uptake. By this method, about 85% of pathological information on the thyroid was correctly abstracted. (auth)

17252 ON QUANTITATIVE MEASUREMENT BY SCINTISCAN. The Characteristics of Count Rate in Scanning. Nishizawa, K.; Tamiya, T. (Nagoya Univ. (Japan). Faculty of Medicine). Kaku Igaku; 11: No. 5, 525-530(Oct 1974). (In Japanese).

The appropriate width of the window for quantitative measurements by scintiscanning and the characteristics of counting rate in scanning was investigated. The comparison of attenuation curves and deformation of the γ-ray spectrum in scanning with a NaI(Tl) detector for a ^{203}Hg point source was examined and the results reported. The integral count over the noise level of the γ-ray spectrum is advantageous to quantitative measurement. The ratio of photopeak count to integral count cannot generally be the index of source depth in water. (auth)

17253 CLINICAL USES OF A LARGE-AREA SCINTILLATION CAMERA. Arimizu, N.; Sawara, N.; Kuchiki, M.; Matsumoto, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Radioisotopes (Tokyo); 23: No. 9, 511-515(Sep 1974). (In Japanese).

A scintillation camera utilizing an NaI crystal of 38.7 cm in diameter has been employed in examinations of 1200 patients for one year and nine months. The effective field of view is 24 cm in diameter, corresponding with approximate 70% larger areas than those of a standard scintillation camera with an NaI crystal of 30.5 cm in diameter. The performances of the large-area scintillation camera were examined regarding its linearity, resolution and uniformity by using ^{57}Co sources. The resolution tests with a lead bar phantom showed image discriminations of the bars of 0.64 cm wide at 5 and 10 cm distant from the collimator. The uniformity was frequently checked by gamma-ray flood exposure on the detector surface, showing spontaneous shifts of uniformity with irregular intervals. The view of large-area scintillation camera covered bilateral lungs in three-fourths of patients without an image distortion, which are shown with a diverging collimator. The large-area view was advantageous in a comparative study of regional respiratory functions of the bi-lateral lungs with ^{133}Xe. The liver and spleen were also represented in one view of an A-P projection in most cases. The bi-lateral kidneys and the urinary bladder, however, came into one view only in one-fourth cases. The large-area scintillation camera was rather disadvantageous in the brain scintigrams, because they were not benefitted by the view much larger than the brain and the big detector was troublesome in fixing the head for the given projection. (auth)

17254 EFFECT OF POSITRON RANGE ON SPATIAL RESOLUTION. Phelps, M. E.; Hoffman, E. J.; Huang, S. C.; Ter-Pogossian, M. M. (Washington Univ., St. Louis). J. Nucl. Med.; 16: No. 7, 649-652(Jul 1975).

The effect of beta$^+$ range on spatial resolution of imaging systems employing the detection of 511-keV annihilation radiation was determined by measuring the variation in the line-spread functions (LSFs) of positron-emitting radionuclides of ^{64}Cu, ^{11}C, and ^{15}O as compared with the 514-keV gamma-ray emitter ^{85}Sr. These radionuclides have maximum beta$^+$ energies of 0.656, 0.960, and 1.72 MeV, respectively. The LSFs were measured in a tissue-equivalent phantom with high-resolution (approximately 2.4 mm FWHM) and low-resolution (approximately 8.8 mm FWHM) straight-bore collimators coupled to a NaI(Tl) detector. Theoretical LSFs for the beta$^+$ ranges were also calculated and convolved with the ^{85}Sr LSF to yield the predicted LSFs for ^{11}C and ^{15}O. The high-resolution study showed a 0 percent and 2.3 percent increase in the full-width half-maximum (FWHM) and full-width tenth-maximum (FW0.1M) for the low-energy beta$^+$ of ^{64}Cu and a 37 percent (FWHM) and 52 percent (FW0.1M) increase for the high energy beta$^+$ of ^{15}O as compared with ^{85}Sr. However, when the system resolution was decreased to 8.8 mm FWHM, the ^{64}Cu showed no change at FWHM or FW0.1M and the ^{15}O showed a 2.3 percent (FWHM) and 7.8 percent (FW0.1M) relative to ^{85}Sr. The predicted LSFs were in good agreement with the experimental. These data indicate that the effect of beta$^+$ range on spatial resolution is minimal unless the beta$^+$ energy is greater than or equal to 1.5 MeV and the system resolution is on the order of a few millimeters. (auth)

17255 POSITRON CAMERA WITH EXTENDED COUNTING RATE CAPABILITY. Muehllehner, G. (Searle Analytic Inc., Des Plaines, IL). J. Nucl. Med.; 16: No. 7, 653-657(Jul 1975).

Positron emitters may be imaged using two opposing scintillation cameras without collimators. The counting rate limitation of this approach can be largely overcome by using graded absorbers to reduce scattered radiation from the patient and using not only photopeak events but Compton events in the scintillator as well. This increases the useful counting rate by more than a factor of 5. By combining this technique with the use of fast electronics, useful images have been obtained in the presence of scattering material at counting rates above 7,500 cps. (auth)

17256 COMBINED HOLDER AND ADAPTER FOR LIQUID SCINTILLATION COUNTERS. Glasser, H. (to Nuclear Associates, Inc.). US Patent 3,883,745. 13 May 1975. Filed date 18 Jun 1973. 6p.

An adaptive container for liquid scintillation counters is described. The adaptive container permits a smaller volume of radioactive material to be accurately measured by a liquid scintillation counter. (Official Gazette)

17257 USE OF CIVIL DEFENSE DOSE RATE METERS FOR THE DETECTION OF FOOD CONTAMINATION. Hardt, H. J. (Bundesamt fuer Zivilen Bevoelkerungsschutz, Bonn). pp 317-324 of Kontamination und dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The suitability of two types of commercially available rate-meters, an end-window counter, and an immersion counter, for the detection of food contamination in the case of nuclear warfare is evaluated. In the first month after nuclear explosions the immersion counter is more suitable, especially for the detection of ^{131}I in milk. (JSR)

Radiation Dosimeters

Refer also to abstracts 17735 and 18748.

17258 (ORNL-tr-2954) $BaTiO_3$: CERAMIC AS A NEW EXOELECTRON EMITTER. Lausch, W.; El Naggar, S. Translated by R. G. Mansfield from Radiochem. Radioanal. Lett.; 12: No. 2/3, 177-184(1972). 5p. Dep. NTIS $4.00.

$BaTiO_3$ ceramic is proposed as a new TSEE-dosimeter for low doses. The preparation of the dosimeter is described and its most important properties are investigated. (auth)

17259 ESTIMATION OF EFFECTIVE GAMMA ENERGY BY DIFFERENTIAL RESPONSES OF TLD-100 AND TLD-200 DOSIMETERS. Momeni, M.; Jow, N.; Countis, T.; Worden, L.; Bradley, E. (Univ. of California, Davis). Health Phys.; 28: No. 6, 809-812(Jun 1975).

Thermoluminescent dosimeters LiF (TLD-100) and CaF_2Dy (TLD-200) have distinct energy response to γ-radiation at energies less than 1 MeV (Gorbics et al (Int. J. Appl. Radiat. Isotop.; 19: 81 (1968)). In the investigation the energy response of TLD-100 and TLD-200 to photons of E_{eff} less than 1 MeV were determined and the ratio of the responses was calculated. The ratios were then utilized in an estimation of the effective field energy. (UK)

17260 INTERCOMPARISON BETWEEN PHOTOGRAPHIC, THERMOLUMINESCENT AND RADIOPHOTOLUMINESCENT DOSIMETERS. Deus, S. F.; Watanabe, S. (Instituto de Energia Atomica, Sao Paulo, Brazil). Health Phys.; 28: No. 6, 793-799 (Jun 1975).

A comparison has been made between the responses of three different dosimetric systems, namely, photographic, thermoluminescent (TL) and radiophotoluminescent (RPL) dosimetry. The comparison was divided into two parts. The first one was carried out with known radiation conditions (exposure, normal incidence, energy) in a controlled environment (~27°C temperature, ~70% r.h.). Under these conditions, the response as a function of exposure and energy, the relation of the linearity to the energy, the lowest detectable exposure, and the reproducibility were studied. Response as a function of the exposure at 37 keV_{eff} and at 1 MeV was found to be linear in the region of interest to routine personnel dosimetry for all dosimeters except the films. Although the film response is not linear with exposure, the ratio between the response at 37 keV_{eff} and at 1 MeV does not depend on the exposure, and this allows the determination of a simple correction factor for the radiation energy. Such energy corrections are usually necessary, since all the dosimeters, except the LiF TL dosimeters are strongly energy dependent. In the second part, the relative response of the dosimeters was measured under the uncontrolled condition in personnel dosimetry. Because the $CaSO_4$: Dy is the most sensitive dosimeter, comparisons were made using this dosimeter as the standard, in which case it was found that 20 out of 29 TLD-100 dosimeters gave the same reading within 30%, 13 out of 29 RPL dosimeters agreed within 30%, and only 3 out of 29 films fell within 30%. (auth)

17261 COMMENT CONCERNING THE ASSESSMENT OF POPULATION EXPOSURES TO EXTERNAL ENVIRONMENTAL RADIATION. Becker, K. (Oak Ridge National Lab., TN). Health Phys.; 28: No. 6, 827-828(Jun 1975).

The increasing use of detectors situated at outdoor locations to assess population doses due to natural or artificial external radiation is questioned. Since the average citizen of an advanced industrial country spends only about 5% of his time outdoors, figures thus obtained are misleading as indoors and in vehicles the terrestrial radiation contribution is substantially modified by shielding and/or contributions by the natural radioactivity in building materials. The advantages and drawbacks of the more direct method approach of using small dosimetry units permanently attached to objects such as dentures, which are rarely separated from a person, are discussed. (UK)

17262 DISTRIBUTION EFFECTIVENESS FOR SPACE RADIATION DOSIMETRY. Wilson, J. W. (National Aeronautics and Space Administration, Langley Station, VA). Health Phys.; 28: No. 6, 812-814(Jun 1975).

The general features of the philosophy used in establishing radiation exposure limits for the US space program are presented. Hematological depression is among the major early effects of concern in manned space flight. The fractional cell lethality model for prediction of hematological response is particularly attractive and has been used in parametric analysis of radiation hazard assessment studies for the Skylab mission. In this note it is shown how these ideas can be incorporated into a dosimetric system for the blood forming organ. (UK)

17263 DOSIMETRY INTERCOMPARISONS BETWEEN FAST-NEUTRON RADIOTHERAPY FACILITIES. Smith, A.R.; Almond, P.R. (Department of Physics, The University of Texas System Cancer Center, M. D. Anderson Hospital and Tumor Institute, Houston, Texas 77025); Smathers, J.B.; Otte, V.A.; Attix, F.H.; Theus, R.B.; Wootton, P.; Bichsel, H.; Eenmaa, J.; Williams, D.; Bewley, D.K.; Parnell, C.J. Med. Phys. 2: No. 4, 195-200 (July 1975).

Neutron dosimetry intercomparison visits have been made by physicists from the M. D. Anderson Hospital-Texas A&M University Project to the Naval Research Laboratory, the University of Washington, and the MRC Cyclotron at Hammersmith Hospital. The Naval Research Laboratory and University of Washington physicists have made dosimetry intercomparisons at the Texas A&M Variable-Energy Cyclotron (TAMVEC). The parameters that are usually measured during these visits are tissue kerma in air, tissue dose at depth of dose maximum, relative central-axis depth dose, neutron/gamma ratios in air and in phantom, and photon calibrations of ionization chambers. In addition, beam profiles and dose buildup curves are sometimes measured. Other parameters that are compared are values of W, stopping power ratios, kerma corrections, and calculations that lead to the statement of tumor doses for patients. This paper presents some of the results of the intercomparisons and discusses the implications of the findings. (auth)

17264 CONSTRUCTION OF A THERMOLUMINESCENCE DOSIMETER. (to Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onkerzoek). Netherlands Patent 7,310,204/A/. 23 Jul 1973. 8p. (In Dutch).

The invention discloses the construction of a thermoluminescence dosemeter which is applicable as a dosemeter for ionizing radiation. The system is fully automated. The detector is picked up by vacuum suction, turned round inside a revolving drum and ejected into the heating (or irradiation) chamber. At the same time a calibration sample enters the chamber and the system is calibrated at the beginning of each run. When the wrong type of detector has been inserted it is automatically turned through and discarded via an ejection channel and another detector may be picked up. The detector in the heating chamber is located on the one focus of an illipsoid mirror which directs the emitted light into a photomultiplier tube whose diaphragm is set in the second focus of the mirror. (NL)

17265 NOVEL FAST NEUTRON DOSEMETER BASED ON FISSION CHAMBERS. I. Principles of Operation and Theoretical Response in Neutron Therapy Radiation Fields. Porter, D.; Lawson, R. C.; Hannan, W. J. (Western Regional Hospital Board, Glasgow). Phys. Med. Biol.; 20: No. 3, 431-445(May 1975).

A novel method is proposed of accurately measuring fast neutron doses of interest in radiotherapy. The technique, which utilized calculated neutron fluence-to-kerma conversion factors, was based upon the combination of measurements with calibrated neptunium-237 and uranium-238 pulse fission chambers to obtain a response which matched the variation of kerma with neutron energy. The theoretical performance of a practical instrument has been assessed for a variety of neutron spectra to evaluate the spectrum dependence of the dosemeter. The overall systematic uncertainty using this absolute method of determining the neutron dose under charged particle equilibrium conditions was comparable to that encountered with ionization chamber techniques. (auth)

17266 RESPONSE OF THE FERROUS SULPHATE DOSEMETER TO NEUTRONS. Lawson, R. C.; Porter, D. (Western Regional Hospital Board, Glasgow). Phys. Med. Biol.; 20: No. 3, 420-430(May 1975).

A semi-empirical method of calculating G-values for the ferrous sulphate dosemeter irradiated by neutrons up to 18 MeV has been developed. It utilizes published charged particle G-values along with particle spectra calculated for mono-energetic neutron interactions with the dosemeter medium. All available G-value measurements with neutrons have been evaluated and compared with values predicted by this method. The agreement was excellent for DT generator and cyclotron neutron beams in which the neutron spectra had been accurately determined. However, the predictions could not be completely confirmed for lower energy neutrons because of the large experimental uncertainties in the measured G-values and the lack of detailed information on the neutron spectra. (auth)

17267 COATING MATERIAL COMPOSITION FOR INDICATING RADIATION DOSE. Maruyama, T.; Murata, K. (to Kansai Paint Co. Ltd., Osaka (Japan)). Japanese Patent 1973-20408/B/. 18 Feb 1970. 6p. (In Japanese).

A coating material for indicating radiation dose consists of a resin composition substantially containing polymers that contain at least one kind of an alicyclic acid or acid anhydride having double bonds and that contains chlorine atoms. The resin also contains a color-changeable reduction substance that changes color by the action of hydrogen chloride and/or reduction dyes, which change color by the action of hydrogen chloride. The coating material is

resistant to water and solvents, and weatherproof. The principal components may be combined with polymers such as alkyd resin, acryl resin and epoxy resin. The reduction substances may be 1 to 15% by weight of cobalt naphthenate, cobalt octoate, and iron naphthenate. The reduction dyes may be 0.01 to 1% by weight of benzen azonaphtyl amine, para-dimethyl amino benzen, aniline blue, aniline yellow, indigo carmine. Changes in color are visible. The range of the dose which causes the color change of the coating material is from 0.1 to 30 Mrad, with a preferred range of from 0.5 to 15 Mrad. (JA)

17268 CHARACTERISTICS OF IONIZATION-CHAMBER TYPE EXPOSURE METERS FOR MEDIUM ENERGY X-RAYS. Naoi, J.; Katoh, A. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 299-309(Aug 1974). (In Japanese).

This paper gives some data on the calibration factors obtained by calibration of more than thirty exposure meters of ionization-chamber type performed with the medium energy X-ray exposure standard at the Electrotechnical Laboratory (ETL) during ten years, together with the characteristics of some of the meters, such as the dependence of sensitivity on the radiation quality, incident angle, ambient temperature, etc. The values of the calibration factors of the meters at an effective energy of 100 keV energy range are scattered within a range from 0.9 to 1.1. The variations of the calibration factor in the range of equivalent energy from 30 to 120 keV are found to be about 10% in the case of high precision exposure meters, and 20% in the case of survey meters. (auth)

17269 OFF-LINE COMPUTER PROCESSING FOR PERSONAL MONITORING DATA ON A THERMOLUMINESCENCE DOSIMETER. Furukawa, S.; Matsuda, H.; Kaminishi, T. (Government Industrial Research Inst., Nagoya (Japan)). Nagoya Kogyo Gijutsu Shikensho Hokoku; 23: No. 6, 196-202(Jun 1974). (In Japanese).

The outline of the computer processing for personal monitoring data obtained with a thermoluminescence dosimeter is described. Features of the routine program prepared by the authors are in the following processes; (1) the statistical treatment of data on unclean elements; (2) the normalization of each datum for different monitoring period. The computer processing using the routine program reported here has been effective for the evaluation of personal exposure with an accuracy of 1 mrem per 2 weeks. (auth)

17270 EFFECTIVE ENERGY-TUBE VOLTAGE DEPENDENCE OF DOSIMETERS. Naoi, J.; Sakihara, K.; Katoh, A. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 317-324(Aug 1974). (In Japanese).

The effective energy of continuous x-rays is set at a certain value independent of difference in x-ray tube voltages by using an additional filter of suitable thickness. The voltage dependence of the sensitivity at the effective energies of 30, 50 and 80 keV has been studied in cases of the ionization chamber, pocket dosimeter, glass dosimeter, thermal luminescence dosimeter, and film badge. Consequently it has been found that the quality dependence of the dosimeters is primarily determined by the effective energy and secondarily by the tube voltage. (auth)

17271 EXAMINATION OF ACCURACY OF EXPOSURE MEASUREMENT WITH TLD AND RPLD MADE IN JAPAN. Yamachi, I.; Matsumoto, T.; Moriuchi, Y. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch); Tatsuta, H.; Itoh, G. Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 334-350(Aug 1974). (In Japanese).

Accuracies of exposure measurements have been examined of 9 types of TLD and 1 type of RPLD personal dosimeters in use in nuclear facilities. The process of the examination is as follows: The TLD and RPLD sent from the facilities (makers and users) to the Electrotechnical Laboratory (ETL) are irradiated by the exposure standard to be given specified exposure. The order of the exposure given is 1 to 10,000 mR, and the quality is 30 to 140 keV and 1.25 MeV (^{60}Co) in effective energy. Then the given exposure is measured at each facility with its reader and the measured values are informed to the ETL. The results are arranged at the ETL to obtain the following information: 1) accuracy of exposure measurement, 2) accuracy of quality estimation in exposure measurement, 3) dispersion of observed values obtained in the same exposure measurement, 4) distribution of errors in the whole set of the exposure measurements. The measuring errors of the dosimeters have been within ±25% for gamma-rays but beyond ±25% for x-rays for 70% of the dosimeters. (auth)

17272 ESTIMATING AND MEASURING METHODS FOR THE ABSORBED DOSE OF ELECTRONS. Case of 300 keV Accelerators. Okabe, S.; Tsumori, K.; Tabata, T.; Yoshida, T. (Radiation Center of Osaka Prefecture, Sakai (Japan)); Nagai, A. Oyo Butsuri; 43: No. 9, 909-918(Sep 1974). (In Japanese).

Establishment of accurate and reliable methods for estimation and measurement of the absorbed dose is an urgent need in using low-energy electron accelerators. For the purpose of giving a firm basis for the estimation of the absorbed dose, experimental investigations on transmission and backscattering have been made for electrons of energies most utilized in industrial applications, i.e., 200 to 400 keV. By using the results obtained, an empirical formula expressing the absorbed dose under a practical condition of irradiation parameters has been developed for the case of 300 keV electrons. In order to find a practical and reliable method of dosimetry, characteristics of various film dosimeters have been studied; the characteristics considered are linearity of response, accuracy, and fading effect. Inaccuracy of optical measuring devices for films has also been revealed in this study. Preparation of a manual describing standardized treatments in film dosimetry and centralized supply of films are considered to be necessary for the advance of irradiation engineering. (auth)

17273 A NEW FURNACE TO ANNEAL THERMO-LUMINESCENCE DOSIMETER ELEMENTS. Ohnuma, I.; Otsuka, H.; Tokiwa, S. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Rikagaku Kenkyusho Hokoku; 50: No. 4, 165-169(Sep 1974). (In Japanese).

Thermo-luminescence dosimeters have become frequently used in many fields because they can be employed in a wide range and reused by annealing. Here, a new furnace is presented which is simple in handling and can anneal many elements of dosimeters in a short time. Temperature can be set arbitrarily between 50 and 500°C with a variation of less than 3°C. (auth)

Nuclear Spectroscopic Instrumentation

17274 (ITEF-87) NEW PULSED POWER SUPPLY SYSTEM FOR THE 6m-SPECTROMETER SPARK CHAMBERS. Zaitsev, A. P.; Korol'kov, I. Ya.; Novikova, N. V.; Nozdrachev, V. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 10p. (In Russian). INIS.

A system is described for the pulsed feed of the large optical spark chambers of the 6-meter spectrometer. Open, air discharge units of original construction are used as commutating elements in the system. Test results and design of the system are presented. (SJR)

17275 (N-74-33947) CONSTRUCTION AND CALIBRATION OF A NEUTRON SPECTROMETER IN THE ENERGY RANGE OF 10 TO 50 MeV. Boehm, I.; Boehm, J.; Wibberenz, G. Translated from Atomkernenergie; 21: No. 1, 48-54(1973). 26p. (NASA-TT-F-15931). NTIS $4.50.

The construction and calibration of a neutron spectrometer for measuring solar neutrons is described. A simple circuit is given for electronic separation of gamma rays and neutrons. It is concluded that the inelastic interactions of neutrons with energy of 18 MeV and more with carbon atoms cannot be neglected in the NE 213 scintillator used for neutron detection. (STAR)

17276 USE OF NTA FILMS AS NEUTRON MONITORS IN CRITICALITY ACCIDENTS. Venkataraman, G.; Dhairyawan, M. P. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 28: No. 6, 818-820(Jun 1975).

In an attempt to find a personnel neutron detector to act as a cross check on threshold detectors, the use of cadmium covered Kodak Nuclear Track films (NTA film) has been investigated. Calibration curves for intermediate energy (0.5 eV to 100 keV) and fast neutron doses are presented. (UK)

17277 RESONANCE SPECTROMETER. (to Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek). Netherlands Patent 7,306,456/A/. 9 May 1973. 5p. (In Dutch).

The invention provides an improvement for gyromagnetic resonance spectrometers. In order to reduce the background noise, the frequency generator is stabilized with the measuring chamber which now serves as safety resonator. The phase of that part of the signal that is due to the resonator is separated, converted and fed back to the output channel of the generator in such a way that both signal parts are in phase. (NL)

17278 PORTABLE RADIATION MEASUREMENT DEVICE FOR ESTABLISHING THE DEGREE OF CONTAMINATION OF FOODS BY IDENTIFICATION OF BETA AND GAMMA RADIATION. Frank, A. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp 305-316 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land-und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685--.

The device is designed as a 6-channel spectrometer and is divided into an analog and a digital part. The analog part is used for the classification of the pulses according to height; the digital part consists of an anticoincidence unit for each channel with connected accumulator. The device is suitable for ^{131}I and ^{140}Ba in one range and ^{137}Cs and ^{140}La in another range. A block diagram of the β-γ spectrometer is given and its performance is discussed. (JSR)

17279 MOESSBAUER SPECTROSCOPY. Dale, B. W. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Contemp. Phys.; 16: No. 2, 127-146(Mar 1975).

The underlying theory and the basic instrumental techniques of Moessbauer spectroscopy are briefly described. Applications of the technique in nuclear physics, lattice dynamics, radiation and ion-implantation studies, surface studies, metallurgy, chemistry, and biology are considered and evaluated. (auth)

17280 EFFICIENCY OF THE SCATTERING OF "UNSTABLE" CHARGED PARTICLES IN QUADRUPOLE MASS SPECTROMETERS. Sheretov, E.P.; Kolotilin, B.I.; Safonov, M.P. (Ryazan' Radiotechnical Institute). Sov. Phys.—Tech. Phys. 19: No. 12, 1622-1624 (June 1975).

The scattering of "unstable" charged particles in a quadrupole mass spectrometer is discussed. Equations are derived for the rate at which the unstable particles leave the analyzer. The relations are found by the method of characteristic solutions of the Hill equation. The accuracy of the resulting relations and the phase characteristics of the scattering are discussed. (auth)

High Energy Physics Instrumentation

17281 (INS-TCA-31) MUTRON EQUIPMENT AND HIGH ENERGY MUON PHYSICS. Kitamura, T. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 19 Nov 1974. 18p. (In Japanese). INIS. NTIS (US Sales Only) $4.00.

In order to get information about interactions of muons with energies beyond those produced in accelerators, a new muon TeV-spectrometer, MUTRON, was designed, consisting of a magnet spectrograph and a calorimeter. MUTRON should be used for investigating many subjects which are of concern for cosmic ray physics and high-energy muon physics. In this report, we shall mainly concentrate on discussions of some subject in high-energy muon physics. (auth)

17282 (LUIP-CR-74-16) IMPORTANCE OF NUCLEAR COLLISIONS IN A COUNTER DETECTOR TELESCOPE IN THE DETERMINATION OF THE CHARGE SPECTRUM OF THE IRON GROUP OF THE COSMIC RADIATION. Lindstam, S. (Lund Univ. (Sweden). Fysiska Institutionen). Dec 1974. 29p. Dep. NTIS (US Sales Only) $4.50.

The importance of nuclear collisions of cosmic ray particles in a counter detector telescope is studied by simple Monte Carlo techniques. The interest concentrates on the charge region just below iron and the calculations are restricted to fully relativistic cosmic rays. It is found that it is difficult to avoid a blurring in the charge spectrum from nuclear collisions leading to considerable systematic errors in some abundance ratios. (auth)

17283 ZERO GUIDANCE MEASUREMENT OF BUBBLE CHAMBER PICTURES. Hertzberger, L. O. Amsterdam; Amsterdam Univ. (1975). 110p.

A description of a fully automatic scanning and measuring system for the processing of photographs from the CERN 2m hydrogen bubble chamber is given. This system is now successfully used for measuring photographs of a 7.3 GeV/c anti proton experiment. The hardware of the system consists of a Hough Powell Device (HPD) flying spot scanner, a processor (ZGE) specially developed for the purpose, and a CDC 6400 computer. The rolls of film are digitized on the HPD without any preliminary processing. The incoming beam tracks are detected and followed by the ZGE processor simultaneously with the digitizing process. The beam tracks are followed until either an interaction point or the end of the picture is detected. A minimum guidance program FILTER then takes over control, locates the vertex accurately and measures the tracks leaving the interaction point. After the three views of a roll of film have been processed, the measured interaction points are matched in space, and detected events are then passed through the geometrical reconstruction programs. The topology of the events is checked on hand measuring machines, and missing tracks are recovered. (NL)

17284 PULSE SHAPE CONTROLLED PULSE HEIGHT ANALYZER. Kachel, V. (Max-Planck-Institut fuer Biochemie, Muenchen (F. R. Germany). Abt. fuer Experimentelle Medizin). Elektronik (Munich).; No. 10, 365-370(Oct 1974). (In German).

7 figs.; 2 tabs.; 2 refs.

In the field of nuclear electronics very versatile pulse height analyzers were developed in the last years. These analyzers, often with a very high amplitude resolution are only capable of measuring a single extremum of a short pulse, usually the maximum value. There are often problems to solve where an extreme amplitude resolution is not necessary, but instead the discrimination between pulses of different shape is of importance. The present paper gives a measuring principle and describes equipment using this principle with which such measurements can be done independent of the pulse length. Its application is demonstrated in the determination of biological cell volumes. (auth)

17285 STREAMER PROPAGATION AFTER THE VOLTAGE TERMINATION IN A STREAMER CHAMBER. Rudenko, N.S.; Smetanin, V.I. (Scientific-Research Institute of Nuclear Physics, Electronics, and Automation, Tomsk). Sov. Phys.—Tech. Phys. 19: No. 12, 1616-1617 (June 1975).

Streamers are observed to propagate stably in the direction of the electric field after the voltage in a streamer chamber is cut off. An electron-optical method has been used to study the influence of the initial conditions on this "self-propagation" of the streamers. (auth)

Radiometric Instruments

Refer also to abstracts 17336, 17337, and 17902.

17286 NUCLEAR BORE HOLE LOGGING SYSTEM. (To Texaco Development Corp.). Netherlands Patent 7,312,153/A/. 4 Sep 1973. 14p. (In Dutch).

The invention discloses an improvement for the existing equipment and methods of borehole logging. It aims at monitoring the amplification of peaks from the energy spectra, elimination of non-linear factors such as influence of temperature on the cable, improvement of the reference standard, and greater accuracy of the system. (NL)

17287 IMPROVEMENTS IN AND RELATING TO THE MEASUREMENT OF ABSORPTION OF RADIATION. Hornby, M. R.; Tunstall, D. F. (to British Titan Ltd.). British Patent 1,387,442/B/. 19 Mar 1975. Filed date 20 May 1972. 9p.

An improved method is described for measuring the absorption or scattering of electromagnetic radiation on passage through a liquid containing dispersed powder. The method is simple and enables accurate determination of the Stokes diameter and particle size distribution of powders. It depends on measurements of intensity changes as the powder particles settle in a liquid dispersion. The required apparatus and its mode of operation are described in detail. (UK)

17288 THICKNESS GAGES WITH RADIONUCLIDES FOR THE STRIP THICKNESS CONTROL OF COLD ROLLING MILLS. I. Carl, W. (Frieseke und Hoepfner G.m.b.H., Erlangen (F. R. Germany)). Baender, Bleche, Rohre.; 15: No. 4, 146-152(1974). (In German).

11 figs.; 2 tabs.

Thickness gages are necessary for the control of cold rolling mills, which measure the strip thickness reliably, continuously, fast and without contact. The radiometric measuring technique fulfills all of these requirements. In addition to a brief explanation of the measuring method, the relationships between thickness region, rolled material and type of radiation source to be applied are given. The design of the non-contact thickness gages including the carrying out of the strip thickness measurement is discussed in detail. (auth)

17289 THICKNESS GAGES WITH RADIONUCLIDES FOR THE STRIP THICKNESS CONTROL OF COLD ROLLING MILLS. II. Carl, W. (Frieseke und Hoepfner G.m.b.H., Erlangen (F. R. Germany)). Baender, Bleche, Rohre.; 15: No. 5, 212-215(1974). (In German).

8 figs.; 4 refs.

Radiometrically working thickness gages are used for the control of the strip thickness of cold rolling mills. Special problems arise in the thickness measuring of strips made of alloys, which are connected with the changing of the attenuation coefficients for single alloy components. A calibration by means of mechanically determined thickness values with radionuclides with monoenergetic photon radiation is possible for not too strong deviations of the alloy components. Besides a description of the control point performance and of the control unit, other possibilities of application such as thickness control in coatings are indicated. In the last case, instead of the radiation process, the fluorescence backscattering process is applied. (auth)

17290 DETERMINATION OF COATING DISTRIBUTION BY USING MICROTOME SECTIONING AND NEUTRON-ACTIVATION

ANALYSIS. Grant, G.; Clifton, G. S.; Sheppard, J. C. (Washington State Univ., Pullman). Tappi; 57: No. 4, 127-130(1974).

The sample (1 cm^2 of paper) is cut into sections (usually 10 mu m thick, but sometimes down to 4 mu m) weighing less than 1 mg (down to 300 mu g). Such sections are irradiated in a flux of similarly ordered 2 x 10^{12} thermal neutrons per cm^2 per sec., then gamma-counted by means of a Ge(Li) detector linked to a multi-channel analyzer. By this means, Ti (down to 0.5 mu g) and Zn can be determined from the peaks for ^{51}Ti and ^{65}Zn. By subtracting the wt. of ZnO from the wt. of the layer, a value can also be obtained for the content of organic binder associated with the Zn. If the paper is treated with $IrCl_6^{=}$, these ions become bound to any conductive resin coating; activation analysis for ^{192}Ir then gives an indication of the thickness of the resin coating. (Anal. Abstr.)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

17291 (AD-785661) RADIATION SUSCEPTIBILITY OF HIGH POWER GaAs INFRARED LIGHT-EMITTING DIODES. Polimadei, R. A.; Share, S.; Epstein, A. S.; Gowins, G. P. (Harry Diamond Labs., Washington, D. C. (USA)). 1973. 15p. NTIS $3.25.

The paper reports the effects of gamma and neutron irradiation on the power output and efficiencies of a commercial, high-power GaAs LED of current interest to system designers. (GRA)

17292 PROPERTIES OF COMPENSATED GaAs LIGHT-EMITTING DIODES FOLLOWING ^{60}Co IRRADIATION. Share, S.; Epstein, A. S.; Polimadei, R. A. (Harry Diamond Labs., Washington, DC). Solid-State Electron.; 18: No. 6, 471-480(Jun 1975).

The effect of γ radiation on the light-emitting properties of compensated GaAs electroluminescent diodes has been investigated. For γ doses up to 10^8 rads(Si), a large exponential reduction in the external quantum efficiency is observed, accompanied by a small reduction in the total carrier lifetime. These results are consistent with a model wherein two different defects are introduced through irradiation. These defects in addition to increasing the number of nonradiative recombination centers can also degrade the radiation process directly. Isochronal annealing data on these irradiated diodes suggest that the defect responsible for degrading the radiative process anneals below 300°C, but that the defect responsible for decreasing the nonradiative lifetime is relatively unaffected. The exponential reduction of efficiency with irradiation, including an observed shift of spectral emission peak, as well as the annealing characteristic seen in these diodes suggests that the defect responsible for degrading the radiative process might be similar to the luminescent killer center associated with an arsenic vacancy. (auth)

Miscellaneous Instruments

Refer also to abstract 19156.

17293 (INS-TH-91) FAST LINEAR GATE AND STRETCHER. Watanabe, S.; Mishina, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 29 Nov 1974. 11p. (In Japanese). INIS. NTIS (US Sales Only) $4.00.

A direct coupled, fast linear gate accepts fast bipolar analog signals. The input data signal will be either passed or blocked in response to NIM logic signals. The gate open-time is determined by the pulse width of the internal gate generator. The gate pedestal can be set to zero or to negative level if desired. The pulse stretcher accepts negative or positive fast pulses and delivers stretched pulses with nearly exponential decay or nearly Gaussian wave forms. (auth)

17294 SODIUM DETECTION EQUIPMENT. (to Neratoom NV). Netherlands Patent 7,305,531/A/. 19 Apr 1973. 4p. (In Dutch).

A leak detection method for sodium vapor is described. When multilayer pipes are used with detection channels between the layers, the surfaces of these layers are roughened in a way that capillaries are formed which are connected to the detection channels. Therefore, any possible breach is detected. A leak of 1 mg h^{-1} can be detected in 10 minutes. The high diffusion speed of sodium in vacuum makes this possible. Another advantage is that sodium oxides are also evacuated, which enhances its reduction to sodium metal. (NL)

17295 VERSATILE CRYOSTAT FOR MEASURING THE TRANSITION TEMPERATURE OF THE SUPERCONDUCTORS. Sharma, R. G.; Kishan, H. .(National Physical Lab., New Delhi). J. Phys., E (London); 8: No. 6, 448-449(Jun 1975).

Details of the construction and the performance of a cryostat useful for measuring the transition temperature T_c of superconductors are given. The cryostat is extremely simple in design and provides a working temperature range of 2 to 30°K. The design of the cryostat allows measurement on a large number of specimens with a single helium fill because loss of liquid helium during replacement of samples is nearly negligible. (auth)

17296 IMPROVEMENTS IN OR RELATING TO THE MEASUREMENT OF TEMPERATURE. Le Claire, A. de la M.; Barr, L. W. (to United Kingdom Atomic Energy Authority). British Patent 1,384,373/B/. 19 Feb 1975. Filed date 20 Jun 1971. 3p.

Reference is made to methods for the measurement of temperature in relatively inaccessible regions where it is difficult to introduce electrical or other connections, for example, in nuclear reactors. The method described depends on diffusion between two solids, where the resulting changes in concentration of one solid in the other depend on time and very strongly on temperature. Two different materials, which are solid at the maximum temperature likely to be encountered, are placed in contact with one another in the measurement zone, and changes of concentration over a given time period are determined. These changes may be determined by sectioning the materials and analysis using radioactive tracer methods, or by measuring changes in electrical resistivity. If one of the materials is ferromagnetic the concentration changes may be determined by measuring changes in magnetic properties. Suitable apparatus, in the form of probes, is described; this may consist of a wire of one material coated with the other material. (UK)

17297 INTERACTIVE THREE DIMENSIONAL TREATMENT PLANNING SYSTEM. Haarman, J. W.; van Leiden, H. F.; Pruis, D. (Philips Gloeilampenfabrieken NV, Eindhoven, Netherlands). Medicamundi; 20: No. 1, 23-32(1975).

A description is given of the design philosophy and the operating procedure of the Philips Treatment Planning System. In the design of this system great emphasis has been given to the speed and ease of operation, and the ability to perform complicated three dimensional treatment planning. (NL)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstract 18285.

17298 (CEA-CONF-3031) FRENCH STUDIES ON URANIUM ISOTOPE SEPARATION APART FROM GASEOUS DIFFUSION. Frejacques, C.; Gelee, M.; Massignon, D.; Perrault, M.; Plurien, P. (CEA, 75- Paris (France)). 1975. 6p. (CONF-750324-3). Dep. NTIS (US Sales Only) $4.00.

From international conference on uranium isotope separation; London, UK (5 Mar 1975).

After reviewing the conditions with which every new technique will have to comply in order to be competitive in the 1980's, the different processes studied in France on a laboratory or development scale, as well as their possibilities, are surveyed i.e., centrifugation, selective photochemical excitation, chemical exchange, aerodynamics, and electromagnetics. (auth)

17299 (CEA-CONF-3033) SOME THEORETICAL ASPECTS OF CAPACITY INCREMENT IN GASEOUS DIFFUSION. Coates, J. H.; Guais, J. C.; Lamorlette, G. (CEA, 75- Paris (France)). 1975. 7p. (CONF-750324-4). Dep. NTIS (US Sales Only) $4.00.

From international conference on uranium isotope separation; London, UK (5 Mar 1975).

Due to the sharply growing needs of enrichment services, the problem of implementing new capacities must be included in an optimized scheme spread out in time. The alternative solutions are studied first for a unique increment decision, and then in an optimum schedule. The limits of the analysis are discussed. (auth)

17300 (CEA-CONF-3034) HIERARCHICAL OPTIMIZATION IN ISOTOPE SEPARATION-GASEOUS DIFFUSION: PLANT, CASCADE, STAGE, PRINCIPLES, AND APPLICATIONS. Guais, J. C. (CEA, 75- Paris (France)). 1975. 14p. (CONF-750324-5). Dep. NTIS (US Sales Only) $4.00.

From international conference on uranium isotope separation; London, UK (5 Mar 1975).

The large-scale system represented by a gaseous diffusion plant model, and its hierarchical mathematical structure are the reasons for a decomposition method for minimizing the total cost of enrichment. This procedure which has been used for years in the optimization problems of the French projects is described. (auth)

17301 (UCCND-CSD-14) NEWFIX: A MULTICOMPONENT FIXED PLANT PRODUCTIVITY CODE. User's Guide. Blum, S. R. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 112p. Dep. NTIS $5.45.

The NEWFIX computer code produces a detailed steady-state model of multicomponent stream flows in a "fixed plant" separation cascade. The user must specify fixed plant characteristics and describe the feed streams and desired properties of withdrawal streams. There are no other internal assumptions on the material being separated or type of cascade. NEWFIX is an operational code on the IBM 360, stored and accessed in load module form. Included in this report are a basic description of the code, detailed input and output information, and a sample case. (14 figures) (auth)

17302 (UCRL-76356) AUTOIONIZATION SPECTRA AND HIGH LYING ODD PARITY LEVELS IN URANIUM VAPOR. Solarz, R.; Carlson, L.; May, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 May 1975. 16p. (CONF-750520-9). Dep. NTIS $4.00.

From IEEE Optical Society of American conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

Most uranium isotope separation schemes utilizing lasers require a thorough knowledge of the spectroscopy of the atomic vapor system. A critical assessment of economic feasibility of these separation schemes requires measurement of photoionization cross sections, level positions and their transition probabilities, and lifetimes of as large a number of states of the system as is possible. Recent results from high resolution autoionization experiments, designed to identify high lying odd parity levels in uranium vapor are presented. (TFD)

17303 (UCRL-76829) MACROSCOPIC ISOTOPE SEPARATION OF URANIUM BY SELECTIVE PHOTOIONIZATION. Tuccio, S. A.; Foley, R. J.; Dubrin, J. W.; Krikorian, O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Apr 1975. 19p. (CONF-750520-6). Dep. NTIS $4.00.

From IEEE Optical Society of American conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

Results of an experiment in which milligram quantities of uranium were enriched using selective photoionization are presented. Basically, the technique involved using two, colinear laser beams to ionize ^{235}U atoms emanating from a high temperature oven. The ions were then electrostatically separated from the neutral atoms and collected on a beryllium plate. (auth)

17304 SOURCE-SINK FLOW IN A GAS CENTRIFUGE. Matsuda, T.; Sakuri, T.; Takeda, H. (Kyoto Univ.). J. Fluid Mech.; 69: No. 1, 197-208(13 May 1975).

Steady non-axisymmetric source-sink flow of a perfect gas in a rapidly rotating circular cylinder for the case in which the sources and the sinks are distributed on the top and bottom is considered. A linearized analysis is applied to a small perturbation from the state of rigid-body rotation. It is shown that the radial pressure gradient plays an important role in the determination of the axisymmetric part of the flow field and that the effects of viscosity and thermal conductivity govern the overall configuration of the non-axisymmetric part. It is also shown that the transport of gas in the main inner flow is axial and that radial transport is confined to the horizontal boundary layers. (auth)

17305 VACUUM SYSTEM OF THE ISOTOPE SEPARATION FACILITY AT ALMELO (NETHERLANDS). Smid, J. (Stichting Reactor Centrum Nederland, Petten). Ned. Tijdschr, Vacuumtech.; 13: No. 2, 15-20(Mar 1975). (In Dutch).

The vacuum system of the isotope separation facility at Almelo, the Netherlands is described. The inherent technical problems of the separation process are explained and the specifications are formulated. Some technical solutions which have been used to obtain the required high degree of vacuum integrity in the complex vacuum system are discussed. (NL)

17306 IDEAL CASCADE WITH SIDE FLOW. Kokubu, H. (Sumitomo Atomic Energy Industries Ltd., Osaka (Japan)). Nippon Genshiryoku Gakkaishi; 16: No. 9, 492-497(Sep 1974). (In Japanese).

The ideal cascade with side flow is defined as an ideal cascade where UF_6 of assays lower than that from the final stage is withdrawn, and where also, in addition to the major feed with natural concentration, minor feeds are fed into the cascade. A method of calculation is proposed for finding the flow rates at each stage in an asymmetric ideal cascade with side flow in the case where $\alpha = \beta^S$, α, β and S being the heads separation factor, the tails separation factor and integer, respectively. Using this method of calculation, the flow rate of each stage is obtained for an asymmetric ideal cascade with side flow for the case of $\alpha = \beta^2$ and for a symmetric ideal cascade with side flow for $\alpha = \beta$. (auth)

Isotopic Power Sources

Refer also to abstracts 17087, 17088, 17090, 17453, 17454, and 17559.

17307 (DPST-75-128-6) SAVANNAH RIVER LABORATORY MONTHLY REPORT: ^{238}Pu FUEL FORM PROCESSES. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jun 1975. Contract AT(07-2)-1. 27p. Dep. NTIS $4.50.

In studies of agglomeration in PuO_2 it was observed that increasing the plutonium concentration in the feed stream to the precipitator increases particle agglomeration. High temperature reduces agglomeration; agglomerates are comprised of particles whose size and size distribution are similar to those of individual particles which are not agglomerated; a correlation of median particle size with both tap density and agglomeration has been established which distinguishes between $^{238}PuO_2$ produced before, during, and after the time high sinterability was noted; apparatus and procedures have been developed to directly measure the density of $^{238}PuO_2$ pellets by mercury displacement; studies of cold-pressed pellets have shown that as-calcined PuO_2 from recent production does not compact into integral pellets; and the density of pellets pressed from high sinterability PuO_2 appears to be more sensitive to pressing pressure and to have more variability than pellets from PuO_2 produced before or after the time highly sinterable $^{238}PuO_2$ was produced. Analyses of pellets fabricated from oxalate-based shards show that all non-actinide impurities are within specifications. (auth)

Radiation Sources

Refer also to abstract 17452.

17308 (CONF-720902-, pp 1-13) CALIFORNIUM-252 NEUTRON SOURCES. Crandall, J. L. (E. I. du Pont de Nemours and Co., Aiken, SC). Jun 1975.

From national topical meeting on the applications of Californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Major production programs for the Savannah River reactors and the High Flux Isotopes Reactor at Oak Ridge have made ^{252}Cf one of the most available and, at the USAEC's sales price of $10/mu g, one of the least-expensive isotopic neutron sources. Reactor production has totaled approximately 2 g, and, based on expected demand, an additional 10 g will be produced in the next decade. The approximately 800 mg chemically separated to date has been used to prepare over 600 neutron sources. Most, about 500, have been medical sources containing 1 to 5 mu g of ^{252}Cf plated in needles for experimental cancer therapy studies. The remainder have generally been point sources containing 10 mu g to 12 mg of oxide for activation, well logging, or radiography uses. Bulk sources have also been supplied to the commercial encapsulators. The latest development has been the production of ^{252}Cf cermet wire which can be cut into almost contamination-free lengths of the desired ^{252}Cf content. Casks are available for transport of sources up to 50 mg. Subcritical assemblies have been developed to multiply the source neutrons by a factor of 10 to 40, and collimators and thermalizers have also been extensively developed to shape the neutron flux and energy distributions for special applications. (auth)

17309 (CONF-720902-, pp 61-71) LONG-TERM INTEGRITY OF ^{252}Cf SOURCE MATERIALS. McDonell, W. R.; Mosley, W. C. (E. I. du Pont de Nemours and Co., Aiken, SC). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Preliminary evaluations indicate that spalling of inner capsule surfaces injected with helium gas should be the principal mode of deterioration of ^{252}Cf sources at low temperatures, producing no more than about 0.010-in. thinning of the inner capsule over a 10-y source lifetime. Additional capsule erosion due to alpha particle, neutron, or fission fragment impact should be minor. No deleterious chemical incompatibility of $^{252}Cf_2O_3$ and the platinum alloy capsule is expected below 1000°C, although some ^{252}Cf may be injected into the capsule wall by self-transfer due to fission fragment impact. Hardening and embrittlement of $^{252}Cf_2O_3$-Pd wire forms that may occur because of internal helium generation may be relieved by annealing. Experimental investigations have been undertaken to measure the thinning of ^{252}Cf capsules by helium gas spalling and fission fragment impact, and to verify chemical compatibility of source and capsule materials. Threshold conditions for hardening and embrittlement of ^{252}Cf-Pd wire forms are being determined. (auth)

17310 (CONF-720902-, pp 129-134) MEDICAL APPLICATIONS OF CALIFORNIUM-252. Oliver, G. D. Jr. (M. D. Anderson Hospital and Tumor Inst., Houston, TX). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Primarily, californium-252 sources have been utilized in medicine for the treatment of neoplastic lesions. For five years, a coordinated effort between several cancer research institutions and national laboratories has developed the necessary physics, radiobiology, and engineering skills to establish an evaluation program for californium. Several more years of combined effort are required before it is known whether californium therapy is as good as or better than conventional therapy with sources like radium. Recently, development of diagnostic applications of californium in medicine has received attention. Studies comparing neutron decay activation analysis versus prompt capture gamma ray analysis are in progress. A hopeful application of prompt analysis with reasonable quantities (200 mu g) of californium is the elemental analysis of bone in the human body. (auth)

Design and Fabrication

17311 (CONF-720902-, pp 14-24) FABRICATION OF CALIFORNIUM-252 SOURCES IN THE UNITED KINGDOM. Ainsworth, A.; Brady, M. W.; Thornett, W. H. (Radiochemical Centre Ltd., Amersham, Eng.). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The advent of californium-252 in weighable quantities and at a reasonable price has caused some rethinking among neutron source suppliers. To explore this market the Radiochemical Center Ltd. has purchased 2 mg of californium-252, and subdivided this into a wide range of sources. To take advantage of its high specific neutron emission, a small double welded stainless steel capsule 7.8mm diameter x 10mm high was chosen for stock sources and this entailed the use of a microdispensing technique which had to be specially developed. The apparatus and procedure for subdividing milligram amounts of californium-252 are described. Some details of our experience in processing these one milligram shipments are given. One hundred sources with activities from 200 microgram to 0.01 microgram have been produced. Losses have been small. Measurement of neutron spectra gamma spectra and dose rates from encapsulated sources have confirmed published data. Though it is early days, little industrial interest in californium-252 sources has been detected, most of the sources have so far been required for research into activation analysis and two examples of this are given. (auth)

17312 (CONF-720902-, pp 25-31) FABRICATION OF ^{252}Cf NEUTRON SOURCES AT OAK RIDGE NATIONAL LABORATORY. Van Cleve, J. E. Jr.; Williams, L. C.; Knauer, J. B.; Bigelow, J. E. (Oak Ridge National Lab., TN). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The fabrication of the aluminum pellet containing the californium oxysulfate consists of the following steps: (1) an aluminum tube with a perforated bottom cap is prepared, (2) cation exchange resin is placed in the tube, (3) solution containing the californium is passed over the resin, (4) extra core powder is placed on top of the resin, (5) the resin is pyrolytically decomposed, and (6) the assembly is pressed to the final dimension. The pressed pellet is then placed in a stainless steel outer container and the top cap welded in place. The qualification of the source involves both a helium leak test and an x radiograph to determine the weld quality. In helium leak testing, the leak rate of the source is compared with a standard leak. The ^{252}Cf content of each source is determined by measuring the fast neutrons emitted. The source is decontaminated in a water-shielded, portable decontamination facility. The clean source is shipped to the customer in a 12-ton carrier. (auth)

17313 (CONF-720902-, pp 32-35) FABRICATION OF CALIFORNIUM-252 SOURCES. Parker, W. C. (Instituto Militar de Engenharia, Rio de Janeiro); Sy Ong, A.; Schall, E.; Baruel, J. Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Molecular electrodeposition has been previously employed for the preparation of the transuranium and transplutonium elements. The present communication deals with californium-252 which has been successfully deposited in quantities of from 5 to 250 mu C together with an optimum amount (25 mu g/cm^2) of natural uranium. For quantities of ^{252}Cf exceeding 25 mu g, carrier is no longer required and yields of up to 500 mu g/cm^2 should be realized. The sources, which were plated onto stainless steel and aluminum, display a uniformity of better than 1 percent for an area of 1.5 cm^2. A study of the structure and composition of the sources is being carried out by means of scanning and conventional electron microscopy. The method is simple, rapid and capable of producing sources of superior quality than aqueous plating procedures. (auth)

17314 (CONF-720902-, pp 36-50) ^{252}Cf ENCAPSULATION AND SHIPPING AT SRL. Boulogne, A. R. (E. I. du Pont de Nemours and Co., Aiken, SC). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Techniques were developed at the Savannah River Laboratory to encapsulate ^{252}Cf sources for research and for medical and industrial applications. The sources are for sale or loan under the USAEC market evaluation program. A new facility is described which limits radiation exposure rates to less than 1 mrem/h in normally occupied areas, except for short periods when maximum amounts of up to 100 mg of ^{252}Cf may be handled. Sources as large as 10 mg have been made in this facility. The entire complex is surrounded by up to 48 in. of gamma and neutron shielding. Equipment was designed for remote handling, assembly, and examination of microliter quantities of solutions and capsule components as small as $\frac{1}{8}$-in. cylinders. Special equipment, procedures, and carriers are described for safe, practical handling, storage, and shipment of encapsulated ^{252}Cf. Brief descriptions and photographs of six casks most commonly used for transporting quantities ranging from 100 mu g to 50 mg of ^{252}Cf are included. (auth)

17315 (CONF-720902-, pp 51-60) NEUTRON SOURCES OF PALLADIUM-^{252}Cf OXIDE CERMET WIRE. Mosley, W. C.; Smith, P. K.; McBeath, P. E. (E. I. du Pont de Nemours and Co., Aiken, SC). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Palladium-^{252}Cf oxide cermet has been developed as a versatile, safe source form for ^{252}Cf with low contamination potential. Developmental wire containing 1.85 mg of ^{252}Cf has been sold in three orders to U. S. commercial encapsulators. Bare palladium-^{252}Cf oxide cermet wire containing ^{252}Cf concentrations of 5, 50, or 500 mu g/in. is expected to be offered for general sale in the near future. (auth)

17316 (CONF-720902-, pp 105-111) DESIGN AND FABRICATION OF A MULTIPURPOSE NEUTRON SOURCE SHIELD. Dahlke, L. W. (Sandia Labs., Livermore, CA). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A portable multipurpose solid radiation shield for a 5 mg ^{252}Cf source was designed and constructed to safely investigate its applicability to the nondestructive inspection of weapon components. The source shield features a ten in. square beam port with a manually operated sliding-rotating internal shutter, allowing one to position the source anywhere within this area. By inserting different functional beam plugs into the port one can perform neutron radiography, neutron gaging, and other neutron applications. The basic shielding materials utilized in this 60 in. dia, six ton shield include borated polyethylene, depleted uranium and steel. With a 3.8 mg ^{252}Cf source in the storage position the shield has an average combined neutron-gamma 3 ft mid-plane dose rate of 1.0 mr/h. (auth)

17317 (CONF-720902-, pp 112-115) RADIOGRAPHY AND CAPTURE GAMMA RAY FACILITY FOR CALIFORNIUM-252. Atkinson, G. D. Jr. (NuTex Corp., Austin, TX); Draper, E. L. Jr.; Tomlin, B. B.; Nichols, S. P. Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A californium-252 neutron source facility was designed and fabricated which could be used for thermal neutron radiography and capture gamma ray analysis and would have the following characteristics: (1) be usable as a type A transfer cask, (2) be semi-portable as an analysis facility, (3) be operable in either a horizontal or vertical beam port orientation, (4) be relatively compact, and (5) be economically priced. The resulting 3600-lb unit was a 36 in. dia. by 40 in. high steel drum filled with a polyester resin extended with water and an antifreeze solution, doped with 2 mg/cm^3 boron-10 and 5 vol. percent lead. With the addition of boron, the 2223 keV hydrogen capture gamma ray contribution was reduced by greater than 70 percent. The lead addition further reduced the gamma ray intensity by greater than 80 percent. A 6-in. polyvinyl chloride pipe is concentric with the cylinder axis and extends the length of the shield, allowing diverse possibilities for beam extraction and collimation. (auth)

17318 METHOD OF IRRADIATION OF ELECTRON BEAMS. Arakawa, K.; Inoue, T. (to Matsushita Electric Industrial Co. Ltd., Kadoma, Osaka (Japan)). Japanese Patent 1973-4445/B/. 8 Apr 1969. 3p. (In Japanese).

A method of irradiation using electron beams is provided, which is characterized in that electron beams from an electron source are deflected by electromagnets or permanent magnets so as to also irradiate the end faces of an object. The magnets are arranged at both ends of the object to be irradiated. At the central portion of the electron source, the electron beams advance rectilinearly without being affected by the magnetic fields of the magnets and irradiate the upper surface of the object. The electron beams emerging from the outer portion of the source are deflected by the magnetic fields and irradiate the end faces of the object. (auth)

Industrial Uses

Refer also to abstracts 17167, 17419, and 17420.

17319 (CONF-720902-) APPLICATIONS OF CALIFORNIUM-252. Proceedings of the American Nuclear Society National Topical Meeting, Austin, Texas, September 11–13, 1972. Gage, S. J. (ed.). (Texas Univ., Austin (USA)). Jun 1975. 351p. Dep. NTIS $10.60.

A separate abstract was prepared for each of the thiry-eight papers presented at the conference. (TFD)

For abstracts of individual papers see: 16699, 17308–17317, 17320–17345, and 18864.

17320 (CONF-720902-, pp 75-82) WHAT YOU ALWAYS WANTED TO KNOW ABOUT CALIFORNIUM SOURCE FACILITIES. Atkinson, G. D. Jr. (Univ. of Texas, Austin). Jun 1975.

From national topical meeting on the applications of Californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas September 11–13, 1972. (Texas Univ. Austin (USA)).

The myriad of californium-252 source facilities now constructed or planned exhibit both the diverse interests and often great ingenuity and imagination of the many researchers engaged in discovering and exploiting the applications of californium-252. In this survey of facility designs, representative examples ranging from the most simple and inexpensive to the most complex and costly of systems are reviewed with the intention of providing an overview from which guidelines may be drawn for future applications. (auth)

17321 (CONF-720902-, pp 83-90) CALIFORNIUM-252 DEMONSTRATION CENTER AT GULF RAD TECH. John, J.; Preskitt, C. A. (Gulf Radiation Technology, San Diego). Jun 1975.

From national topical meeting on the applications of Californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A Californium-252 Demonstration Center has been established jointly by the United States Atomic Energy Commission and Gulf Radiation Technology at Gulf's laboratories in San Diego, California. This Center, now in operation, makes it possible for universities and industries to evaluate applications of ^{252}Cf with a minimum of expenditure. The AEC has deposited at this Center several ^{252}Cf sources adding up to 100 mg valued at $1 million. Gulf has fabricated, at its own expense, the source storage and handling facility, the thermal neutron activation facility and a bare source irradiation facility for the Center. Gulf is providing the Center nearly $1.3 million of research equipment which is available to users at no cost and the Government-owned equipment valued at $3 million will soon be also available. Users have access to Rad Tech's engineering and electronic design and fabrication facilities and to its professional staff for consultation. The facilities at the Center, its mode of operation, procedures for using the Center and its current programs are described. (auth)

17322 (CONF-720902-, pp 91-96) CALIFORNIUM-252 NEUTRON ACTIVATION FACILITY AT THE SAVANNAH RIVER LABORATORY. Peterson, S. F. (E. I. du Pont de Nemours and Co., Aiken, SC). Jun 1975.

From national topical meeting on the applications of Californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A neutron irradiation facility has been established to develop new analytical methods and for the support of research programs. A major component of this facility is a ^{252}Cf source which provides both fission spectrum and thermal neutrons. (auth)

17323 (CONF-720902-, pp 97-104) DESIGN CONSIDERATIONS FOR A PROMPT NEUTRON ACTIVATION ANALYSIS FACILITY UTILIZING A ^{252}Cf SOURCE. Greenwood, R. C. (Aerojet Nuclear Co., Idaho Falls, ID). Jun 1975.

From national topical meeting on the applications of Californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The application of ^{252}Cf as a source of neutrons for prompt neutron activation analysis (PNAA) is discussed. To date, the application of the PNAA technique has principally been confined to nuclear reactor facilities. This dependence on reactor neutrons has severely restricted the use of the technique in industrial applications. While a system for PNAA which is based upon ^{252}Cf appears promising, it still must be recognized that the usable neutron fluxes available with such a facility are considerably less than those obtainable from even a small nuclear reactor. Hence, it is imperative with such a ^{252}Cf based system that optimum design be achieved, in order that acceptable sensitivities might be obtained. The emphasis of the work described has been to determine those design parameters of such a PNAA facility which critically affect sensitivity. A 2-mg source of ^{252}Cf was used in these investigations, and experimental studies were conducted for two basically different ^{252}Cf source-sample-detector geometries. These were: (1) an external beam geometry, in which the sample was irradiated in a beam of neutrons outside the biological shield, and (2) an internal target geometry, with the sample located close to the ^{252}Cf source in a tangential beam tube. Based upon these experiments, specific recommendations on the design parameters for a PNAA facility, using either of these two geometrical arrangements, in order to achieve maximum detection sensitivities are made. (auth)

17324 (CONF-720902-, pp 135-142) USES OF CALIFORNIUM-252 IN INDUSTRIAL PROCESS CONTROL. Rhodes, J. R. (Columbia Scientific Industries, Austin, TX). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Neutron-gamma methods of elemental analysis have considerable potential in industrial process control, particularly for continuous analysis of process streams and bulk materials. As a neutron source, californium-252 has significant advantages over both machine sources and other isotopes, and its availability will help to realize the potential of the methods. Two analysis techniques are under active study and their progress and prospects are reviewed in this paper. They are neutron activation and neutron capture gamma-ray spectrometry. The following determinations have been investigated recently, using one or both methods: vanadium, cobalt and fluorine in process solutions; aluminum, silicon, fluorine, barium, calcium, iron, nickel, copper and silver in minerals and ores; sulphur and ash in coal; and Mn in process samples of steel. (auth)

17325 (CONF-720902-, pp 143-156) COMPARISON OF NUCLEAR REACTOR AND ^{252}Cf NEUTRON CAPTURE GAMMA-RAY STUDIES OF MANGANESE, IRON, NICKEL AND COPPER. Wiggins, P. F. (U. S. Naval Academy, Annapolis); Duffey, D.; Senftle, F. E.; ElKady, A. A. Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The feasibility of using californium-252 for capture gamma studies is demonstrated. A 30 cm^3 lithium drifted germanium detector, i.e., Ge(Li) with a 120 microgram ^{252}Cf neutron source measured the high energy (4.5 to 8.5 MeV) neutron capture gamma rays from manganese, iron, nickel and copper. A 400 pulse height channel analyzer provided both graphical and digital results. The ^{252}Cf results were in accord with the reactor studies of others. Simulated field borehole studies show promise for an in situ field unit containing a ^{252}Cf neutron source and germanium drifted Ge(Li) gamma ray detector for mineral exploration and analysis. (auth)

17326 (CONF-720902-, pp 157-165) STATISTICAL STUDY OF ACTIVATION ANALYSIS RESULTS USING ISOTOPICALLY AND MACHINE PRODUCED NEUTRONS. Braier, H. A.; Miller, F. G. (Gulf Research and Development Co., Pittsburgh). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A van de Graaff electron accelerator coupled to a photoneutron source and a ^{252}Cf irradiator were statistically compared in regard to the analysis of vanadium, chlorine, and aluminum by neutron activation. The work was conducted with five groups of samples each containing a number of identical specimens. Each group was analyzed under identical conditions. The same specimens and standards were successively irradiated with both neutron sources, using the same irradiation, delay and counting times, the same counting system and obtaining approximately the same counts. In this way any significant difference in results can be attributed to the irradiation sources. Precisions are compared by means of the F-ratio test of variance and means were correlated using the t-test. Statistical calculations were done at the 0.01 level of significance. Variances, standard deviations and ranges of grouped samples indicate that superior precision was attained using the ^{252}Cf source. (auth)

17327 (CONF-720902-, pp 166-175) CALIFORNIUM-252 AND 14-MeV NEUTRON ACTIVATION: A COMPARISON. Lauff, J. J.; Champlin, E. R. (Eastman Kodak Co., Rochester, NY). Jun 1975.

From national topical meeting on the applications of Californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The use of a ^{252}Cf and a Cockroff–Walton generator for neutron activation work at the Eastman Kodak Company Research Laboratories, Rochester, N. Y., is described. A performance comparison of the two sources is given. (TFD)

17328 (CONF-720902-, pp 176-180) DETERMINATION OF CEMENT IN SOIL-CEMENT MIXTURES USING ^{252}Cf. Iddings, F. A.; Arman, A.; Miller, L. W. Jr.; Landry, E. J.; Courtney, J. C. (Louisiana State Univ., Baton Rouge, LA). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The determination of cement in soil-cement mixtures using neutron activation analysis is described. The neutrons produced by ^{252}Cf thermalize in a hydrogenous matrix and activate the calcium in cement through the $^{48}Ca(n,gamma)^{49}Ca$ reaction. Activation and counting times take 10 minutes each or less, depending upon source size, sample size, detector size, and geometries of the systems. With 10^4 n cm^{-2} sec^{-1} thermal neutron flux and a 4 in. x 4 in. NaI(Tl) detector, calcium-49 activities can give ±5 percent of the cement content in 3 kg samples. Shorter analysis time or smaller neutron sources may be used if larger detectors are used. Results from a laboratory system and a system designed for field work are presented. (auth)

17329 (CONF-720902-, pp 181-190) ON-STREAM VANADIUM PROCESS ANALYZER USING A ^{252}Cf NEUTRON SOURCE. Orange, J. M.; Larson, J. G. (Gulf Research and Development Co., Pittsburgh). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11-13, 1972. (Texas Univ., Austin (USA)).

A continuous neutron activation analyzer for use in the oil industry to monitor the vanadium content of hydrocarbon process streams is described. (TFD)

17330 (CONF-720902-, pp 207-217) SHIPBOARD USE OF CALIFORNIUM-252 FOR NEUTRON ACTIVATION ANALYSIS: A NEW OCEANOGRAPHIC TOOL. Noakes, J. E. (Univ. of Georgia, Athens); Harding, J.; Spaulding, J. D. Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 1–13, 1972. (Texas Univ., Austin (USA)).

Several field tests have been made over the past three years involving the application of neutron activation analysis at sea. The neutron source was ^{252}Cf. The initial tests were performed in the Pacific Ocean off the coast of California in which a 200 microgram ^{252}Cf neutron source and detection systems were installed on a submersible (Westinghouse Deepstar 2000). The primary objective of these initial sea trials was to prove the reliability of the analytical system, as well as the overall feasi-

bility of taking a neutron source to sea. All facets, including that of health physics proved positive. Subsequent investigations were also performed in the Gulf of Mexico and on the continental shelf off the southeastern U. S. coast where in situ mineral analysis was performed. In the latter tests, television equipped scuba divers and underwater sleds were used as the undersea vehicles. Early in 1972, a 1 milligram ^{252}Cf neutron source and a more sophisticated analytical system were taken to sea for an extended cruise in the Pacific Ocean, during which the source and all support equipment remained on shipboard. The elemental content of bottom sediments and deep-sea nodules was measured from material brought to the surface by cores and grab samples. On the same cruise, sea-water samples were collected from various water depths and were analyzed immediately for trace element composition. In summary, the authors feel that the use of a ^{252}Cf neutron source at sea will provide an important new shipboard analytical tool to the oceanographic community. (auth)

17331 (CONF-720902-, pp 218-228) FEASIBILITY STUDY ON NUCLEAR METHODS USING ^{252}Cf FOR THE EXPLORATION OF MARINE MINERAL DEPOSITS IN SHELF AREAS. Stegmaier, W.; Pepelnik, R.; Suppan, A. (Nuclear Research Center, Karlsruhe, Ger.). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 1–13, 1972. (Texas Univ., Austin (USA)).

For the exploration of marine mineral deposits in shelf areas additional systems will be required in order to supplement the results of other methods and determine in a short time the amount and the concentration of the minerals. The neutron induced gamma-radiation measurement is an appropriate method for this problem. To obtain high-resolution analysis it is necessary to use Ge(Li)-detectors. The employment of cryostats keeping the diodes at low temperature is only applicable to scientific but not to industrial applications. In this case, cryogenerators will be required. The design of borehole-sondes is influenced by the arrangement of cryogenic apparatus and the technique of lowering the probes into the seafloor. Besides the possibility of probe penetration into the sediment on the bottom of the sea, the sample can also be transferred to the measurement system. (auth)

17332 (CONF-720902-, pp 231-239) APPLICATIONS OF A 1.25 mg ^{252}Cf NEUTRON SOURCE IN INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF LUNAR SAMPLES AND IN CONTINUOUS ANALYSIS OF STREAMS. Janghorbani, M.; Sya, C. L.; Ehmann, W. D. (Univ. of Kentucky, Lexington). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society National Topical meeting, Austin, Texas, September 1-13, 1972. (Texas Univ., Austin (USA)).

Applications of a 1.25 mg ^{252}Cf neutron source to instrumental neutron activation analysis of lunar samples are discussed. It is shown that such a neutron source may be used to supplement capabilities of a 14 MeV neutron generator to obtain complete major and minor elemental abundances nondestructively in samples of geochemical and cosmochemical interest. Some other applications of ^{252}Cf neutron source are also presented. (auth)

17333 (CONF-720902-, pp 241-244) MULTI-ELEMENT NEUTRON ACTIVATION ANALYSIS OF SEDIMENT USING A CALIFORNIUM-252 SOURCE. Hayes, D. W.; Peterson, S. F. (E. I. du Pont de Nemours and Co., Aiken, SC). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The application of a ^{252}Cf source to the neutron activation analysis of several elements in small (approximately 1.5 in. in dia) cores was studied using high-resolution gamma ray spectroscopy and manual data reduction. (auth)

17334 (CONF-720902-, pp 245-254) DEVELOPMENT OF IN-SITU MINERAL EXPLORATION METHODS BY MEANS OF ^{252}Cf. Fanger, U.; Pepelnik, R. (Nuclear Research Center, Karlsruhe, Ger.). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The neutron induced gamma radiation of natural mineral samples has been investigated with high-resolution Ge(Li) diodes both in reactor beam and ^{252}Cf experiments. To test the utility of ^{252}Cf for in-situ exploration, a simulated bore-hole facility for scheelites and a seawater tank for manganese nodules have been used. Sensitivity and precision related to background and calibration problems seem to allow the quantitative determination of small percentages of W, Ti, Ni, Cu, Co, Mn, and Fe in a few minutes. A calibration method is given which is based on internal gamma-ray lines only. For an in-situ experiment in 500 m deep water-filled boreholes near Mittersill, Austria, a versatile probe was constructed. Because of the module technique utilized, this probe can be mounted in different arrangements to allow for three experimental modes: XRF, (n,gamma), and NAA. (auth)

17335 (CONF-720902-, pp 255-258) DESIGN OF A SYSTEM FOR THE UNDERSEA EXPLORATION OF MANGANESE NODULES BY ^{252}Cf NEUTRON INDUCED GAMMA RAY ANALYSIS. Boehme, G.; Glaser, B.; Prech, V. (Nuclear Research Center, Karlsruhe, Ger.). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

A system for in-situ-analysis of manganese nodules has been designed. It permits the investigation of the concentrations of Ni, Cu and Co in concretions on the deep sea bottom. The surface sediments are collected by a suction system and conveyed into a tank where they are irradiated by neutrons emitted from a ^{252}Cf source. The neutron-capture gamma rays are analyzed by a cooled Ge(Li) detector system. At the same time the bulk density of the nodules is measured by ^{60}Co irradiation and a NaI(Tl) detector. The total device has an analysis cycle of about 15 minutes. It is towed by a ship over the sea bottom. (auth)

17336 (CONF-720902-, pp 259-264) VOID FRACTION DETERMINATION WITH FAST AND THERMAL NEUTRONS FROM A CALIFORNIUM SOURCE. Hahn, O. J. (Univ. of Kentucky, Lexington). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The methods of void determination with neutrons can be grouped into thermalization of fast neutrons by hydrogenous materials in small samples, into attenuation of thermal neutrons by hydrogenous materials, and into moderation and attenuation of fast neutrons in hydrogenous materials which contain strong thermal neutron absorbers. A small probe was developed consisting of a californium source and a detector in a cadmium hull which allowed the traverse of a water tank to determine local void fractions. Some boundary effects were observed. Neutrons from the californium were thermalized in a nylon sleeve and collimated for void fraction determination. Calculations using exponential absorption with a polynomial build-up factor were used to determine void fractions. A neutron beam passing through a water test section containing a high amount of dissolved boron was directly related to the amount of local thermalization and thus the fast neutron flux. The fast flux was related to the average void fraction along the beam. Collimation was only needed for the detector. (auth)

17337 (CONF-720902-, pp 265-273) NEUTRON GAUGING APPLICATIONS USING A SMALL ^{252}Cf SOURCE. Helf, S. (Picatinny Arsenal, Dover, NJ). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The use of a small ^{252}Cf source, in the 3 to 4 mu g range, for neutron gauging applications is described. Emphasis is placed on determination of low concentrations of moisture in homogeneous media, e.g., solvents, explosives, dried food products, etc. and on measurement of charge or fill weight of hydrogenous materials in sealed items, e.g., propellant in a cartridge case. Both moderation of fast neutrons and attenuation of thermalized neutrons have been explored for these applications. Parameters related to the attainment of optimum sensitivity for each method are discussed. Fast neutron moderation is superior for low level moisture measurement whereas thermal neutron attenuation is more sensitive for "neutron weighing" applications. Under optimum conditions, sensitivity for moisture measurement approaches 0.1 weight percent whereas "neutron weighing" can detect changes in hydrogeneous material content as little as a fraction of a gram. Examples are given for each technique. A number of different thermal neutron detectors are compared for neutron gauging measurements. A ^{6}LiI (Eu) scintillation detector is judged to be superior with regard to high thermal neutron detection efficiency

and low fast neutron and gamma ray response. In this study, emphasis is placed on the use of simple, portable equipment easily adaptable to field or plant use and for on-line process or quality control. (auth)

17338 (CONF-720902-, pp 277-281) ^{252}Cf NEUTRON SOURCE SYSTEMS FOR THE ASSAY OF URANIUM AND PLUTONIUM IN FUEL RODS. Menlove, H. O. (Los Alamos Scientific Lab., NM). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Two assay systems which utilize ^{252}Cf neutron sources for the measurement of fissile content in reactor fuel rods are described. The first system uses thermal neutron interrogation to induce fission reactions in the fuel rod and fast neutrons from the induced reactions are counted using energy-biased ^{4}He-gas recoil detectors to give the total fissile content in the rod. In addition, to obtain the desired spatial resolution for pellet-to-pellet measurement, a small NaI detector to measure the delayed gamma-ray response has been positioned near the fuel rod exit port of the ^{252}Cf shield. Using a 400 mu g ^{252}Cf source, the counting rate in the ^{4}He detector is approximately 6000 cps and the rate from the NaI detector is approximately 95,000 cps for a PWR-type rod (3.3 percent enriched). To measure fuel rods with high fissile density such as FFTF rods, thermal neutron interrogation has inadequate penetration and a fast neutron irradiation system has been built. This system uses large NaI detectors positioned near the ^{252}Cf shield to measure the delayed gamma rays from the sample. Measurements on FFTF-type fuel rods gave net signal rates greater than 4000 cps for detector bias energies greater than or equal to 1.2 MeV using a 600 mu g ^{252}Cf source. (auth)

17339 (CONF-720902-, pp 282-293) DISCRIMINATION OF URANIUM AND PLUTONIUM BY GAMMA RAY ANALYSIS FOLLOWING CALIFORNIUM-252 NEUTRON INTERROGATION. Bauer, T. L.; Atkinson, G. D. Jr. (Univ. of Texas, Austin). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Preliminary results from active neutron interrogation studies of plutonium and uranium fissile samples are presented. Fast and moderated ^{252}Cf neutron fluxes were used to induce delayed fission product gamma ray signatures for comparative analyses by different linear least-squares techniques. Discrimination ratios of 10.4 for plutonium/uranium and 4.4 for uranium/plutonium were obtained. (auth)

17340 (CONF-720902-, pp 294-299) RADIOGRAPHY USING CALIFORNIUM-252 NEUTRON SOURCES. Ray, J. W. (Battelle Columbus Labs., OH). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

The current status in the technology of neutron radiography using californium-252 neutron sources is summarized. Major emphasis is on thermal neutron radiography since it has the widest potential applicability at the present time. Attention is given to four major factors which affect the quality and usability of thermal neutron radiography: source neutron thermalization, neutron beam extraction geometry, neutron collimator dimensions, and neutron imaging methods. Each of these factors has a major effect on the quality of the radiographs which are obtained from a californium source neutron radiography system and the exposure times required to obtain the radiographs; radiograph quality and exposure time in turn affect the practicality of neutron radiography for specific nondestructive inspection applications. A brief discussion of fast neutron radiography using californium-252 neutron sources is also included. (auth)

17341 (CONF-720902-, pp 300-311) CALIFORNIUM-252 NEUTRON RADIOGRAPHY AT BATTELLE-NORTHWEST. Swinth, K. L. (Battelle-Northwest, Richland, WA). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Efforts underway at Battelle since 1969 in ^{252}Cf neutron radiography have led to development of three source holders as well as various imaging techniques. Gadolinium oxysulfide scintillation screens are intermediate between gadolinium metal foils and ^{6}LiF–ZnS screens, thus providing an excellent converter for source radiography. The use of europium foils and x-ray intensifying screens extends the capability of transfer radiography to fluxes of about 1 x 10^{3} n/cm^{2}-sec. An image intensifier has increased imaging speeds ten-fold, and the development of an imaging counter has made imaging information available in a digital form. Applications for ^{252}Cf neutron radiography evaluated at Battelle include: forensic science, polymer loading of concrete, and nuclear fuel applications. (auth)

17342 (CONF-720902-, pp 312-319) RADIOGRAPHY WITH THE FISSION NEUTRONS FROM CALIFORNIUM-252. Antal, J. J. (Army Materials and Mechanics Research Center, Watertown, MA); Becker, R. L. Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Fission neutron radiography, with images formed on thin sheets of cellulose nitrate, has been investigated using neutrons from ^{252}Cf. A polyethylene converter provides recoil protons from neutron elastic scattering by hydrogen, which in turn create damage in the cellulose nitrate. Chemical etching then produces a frosted etch-track image which can be reproduced photographically by either scattered or transmitted light. The most readily available cellulose nitrate sheets were found to contain undesirable internal defects and thus films are recast in thicknesses of several mils. The images are of high resolution, as expected from a computer calculation which considered the direction and ranges of the recoil protons in polyethylene. All materials including those of low atomic weight, may be radiographed with good penetration. The technique is simple and employs inexpensive materials. (auth)

17343 (CONF-720902-, pp 320-327) APPLICATIONS OF CALIFORNIUM-252 FOR NEUTRON RADIOGRAPHY OF MUNITIONS ITEMS. Barnes, E. G.; Drucker, G. (Picatinny Arsenal, U. S. Army, Dover, NJ). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Picatinny Arsenal is evaluating the use of californium-252 for neutron radiographic examination of loaded army munitions items. A nominal 10 milligram californium source was acquired under the AEC's Market Evaluation Program, and facilities for its use were developed at the arsenal. A combination shipping and storage container capable of holding up to 40 milligrams of Cf-252 was designed and fabricated. A versatile source handling mechanism which accommodates a number of different experiments was devised by modifying a standard cobalt-60 source system, and was incorporated as an integral part of the storage/shipping container. Thermal neutron radiography is performed with the Cf-252 source extended to the center of a hydrogenous moderator that is separate from the storage cask. Two moderator designs have been used thus far. The first, an assembly of paraffin slabs with a cadmium and lead collimator, has been replaced by a 2 ft polyethylene cube with a novel gadolinia/bismuth collimator, providing considerable improvement in neutron flux output. Several film-screen combinations were tested, the most useful being gadolinium screens with standard radiographic film. Applications of neutron radiography using the californium source have included 100 percent examination of a pilot production run of 1300 explosive boosters, as well as a variety of other small munitions items. Its principal value has been the ability to determine proper quantity and placement of explosive and propellant fillers inside metal inclosed ammunition components. (auth)

17344 (CONF-720902-, pp 328-333) CALIFORNIUM-252 NEUTRON MULTIPLIER FOR NEUTRON RADIOGRAPHY AND ACTIVATION ANALYSIS. Miller, L. G.; Kunze, J. F. (Aerojet Nuclear Co., Idaho Falls, ID). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

It has become increasingly evident that small milligram quantities of ^{252}Cf will not produce neutron activation or radiography capabilities for high resolution production work. Quantities of the order of 50 to 100 mgs are required if neutron activation and radiography are to become an industrial tool. Fluxes of sufficient intensity for neutron activation and radiography can be obtained

from a few mgs of ^{252}Cf with the use of a subcritical neutron multiplier at a cost savings over a large ^{252}Cf source. Two different models of multipliers have been tested and used at Aerojet Nuclear Company. One multiplier has a large irradiation region for irradiating large samples whereas the second is a compact optimized multiplier for producing neutron radiography beams and irradiating small capsules. These experiments indicate that a neutron multiplier for multiplying ^{252}Cf neutrons can be built safe and at considerable savings over equivalent large ^{252}Cf neutron sources. High resolution neutron radiography is possible with this device, having a neutron flux of 5×10^5 n/cm^{2}sec with a resolution L/D equals 250. (auth)

17345 (CONF-720902-, pp 334-343) NEUTRON RADIOGRAPHY RESEARCH USING ^{252}Cf AT GENERAL DYNAMICS' CONVAIR AEROSPACE DIVISION. Dungan, W. E. (General Dynamics, Fort Worth, TX). Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11–13, 1972. (Texas Univ., Austin (USA)).

Neutron radiography research using 10 milligrams of ^{252}Cf consisting of 4 sources in a water-moderated tank facility is described. Conventional direct-exposure techniques were employed with thermal neutrons from a 6-in. dia beam port. Typical examples with components representative of aerospace products are presented. Neutron radiography is compared with x-ray radiography for the cited examples, which include pyrotechnics and polyurethane insulation. (auth)

17346 (IEA-331) TECHNIQUE FOR TRACKING AND LOCATING SCRAPERS IN DEEP UNDERGROUND PIPES USING ENCAPSULATED SOURCES OF ^{24}Na. Szulak, C.; Castagnet, A. C.; Said, M.; Ohara, T.; Duarte, U. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Apr 1974. 42p. (In Portuguese). Dep. NTIS (US Sales Only) $5.25.

A tracer technique being used in Brazil to locate and measure the speed of hydraulically-propelled scrappers for cleaning water lines is described. The scrapers are of the type commerically designated as "Polly-Pig". The tracer is a 2C: source of ^{24}Na encapsulated in the scraper. The detector is a NaI(Tl) scintillation probe connected to a portable rate meter and graphical recorder. (TFD)

17347 (NP-20498) ANNUAL REPORT FOR 1974. (Institut National des Radioelements, Brussels (Belgium)). 31 Mar 1975. 71p. Dep. NTIS (US Sales Only) $6.75.

The activities of the IRE for 1974 are summarized. The most important of these are the preparation of radioisotopes and radiopharmaceuticals, study on non-medical applications of radioisotopes, and the transition of the program for radiosterilization of medical-surgical material to a semi-industrial status. A project is under study for the radiosterilization of hospital wastes. The financial and administrative function of the IRE is summarized. (JSR)

17348 (NP-20511) OPERATION OF A PILOT PLANT FOR THE DISINFESTATION OF CORN BY IRRADIATION. de la Piedad Beneitez, A. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). Mar 1975. 184p. (In Spanish). Dep. NTIS (US Sales Only) $12.25.

Thesis.

The fundamental aspects of the concepts and terminology in the area of radiation and its effects are discussed with a consideration of radiation sources, interaction of electrons with matter, heavy charged particles, electromagnetic radiation, chemical effects of radiation, and radiation dosimetry. The economic, political, and sociological aspects to be considered in corn disinfestation by radiation are discussed. The pilot plant for corn disinfestation with electrons is described in detail. The two experiments made, one with PVC in order to determine the uniformity of the dose over the irradiation channel and the other with LiF capsules to determine the dose, in order to determine the optimum operating conditions are reported and discussed. (JSR)

17349 (STI/PUB–394) REQUIREMENTS FOR THE IRRADIATION OF FOOD ON A COMMERCIAL SCALE. Panel Proceedings Series. Conference Held in Vienna, Austria, March 18–22, 1974. (International Atomic Energy Agency, Vienna (Austria)). Mar 1975. 224p. (CONF-740371–). IAEA $14.00.

A separate abstract was prepared for each of the twenty papers presented at the conference. (TFD)

For abstracts of individual papers see: 17358–17377.

17350 ANTI-GERMINATION TREATMENT OF POTATOES BY IRRADIATION: APPLICATION PROSPECTS IN BELGIUM. Schietecatte, W. (National Inst. of Radioelements, Fleurus, Belgium); Nys, L. Rev. IRE; 1: No. 2, 19-30(Jun 1974). (In French).

A general survey was given of the scientific research done in Belgium in view of sprout inhibition of potatoes by means of gamma irradiation. The results were evaluated quantitatively, qualitatively, and industrially. This radiation treatment is compared with the procedure based on the addition of chemical products, i.e., prophamchlorpropham. It is plausible when certain adjustments are made and besides very promising in the field of making food more healthy. In order to be able to judge its practical value, it has to be tested in adequate installations. Yet the cost price of the new procedure is still higher than that of the chemical procedure. Taking into account its present evolution and as long as the chemical treatment is authorized one has to conclude that the irradiation of potatoes cannot yet be considered as an industrial procedure in Belgium. (auth)

17351 INFLUENCE OF A CONTINUED MECHANICAL DESPROUTING OF POTATO TUBERS ON WEIGHT LOSS AND TUBER QUALITY. Paetzold, C.; Hammer, C.; Gehre, H. (Forschungsanstalt fuer Landwirtschaft, Voelkenrode, Ger.). Qualitas Plant. Mater. Veg.; 24: No. 3, 367-390(May 1975). (In German).

The influence of a continued mechanical desprouting of potato tubers on weight loss and tuber quality was investigated in comparison with tuber γ irradiation and the untreated control. Mechanical desprouting of tubers resulted in minimum weight loss, but it caused increased sugar content, rotting, and internal sprouting. To give consumers an alternative for the conventional sprout prevention methods, tubers of varieties with a natural deep dormancy, and potato storage in low temperature should be preferred. (NL)

17352 USE OF GAMMA RADIATION IN RADIOSTERILIZATION AND IN OTHER INDUSTRIAL DOMAINS. Schietecatte, W. (National Inst. of Radioelements, Fleurus, Belgium). Rev. IRE; 1: No. 3/4, 12-16(Dec 1974). (In French).

The use of gamma radiation industrially can be divided into applications based on its chemical effects and applications based on its biological effects. The treatment of food and radiosterilization are subdivisions of applications based on biological effects. A brief review is given of the technical bases of gamma irradiation. Examples are given of the use of gamma radiation in polymer modification, polymerization, and radiosynthesis. The problems connected with gamma irradiation of food, its advantages, and the products authorized by different countries for irradiation processing are reviewed. In radiosterilization there has been a rapid industrial evolution. Its technical and economic advantages are cited with particular reference to its use in the medical sector. (JSR)

17353 APPLICATIONS OF TRACERS AND SMALL SEALED SOURCES. Depoitier, J. (National Inst. of Radio Elements, Fleurus, Belgium). Rev. IRE; 1: No. 3/4, 17-24(Dec 1974). (In French).

From conference given at the Royal Society of Engineers and Manufacturers; Brussels, Belgium (9 May 1974).

Three examples are given of the industrial use of tracers. The first is in a rotating furnace of a Belgian cement factory. The second is in the study of the longitudinal dispersion of a polluting agent in a river. The third is in the use of a sealed source for direct measurements in an anemometer. The factors considered in the selection of the tracer or a source are discussed for each of the three cases. (JSR)

17354 EFFECT OF GAMMA IRRADIATION ON THE STORAGE LIFE OF CLEMENTINES. Magaudda, G. (CNEN, Casaccia, Italy). Ind. Conserve.; 49: No. 2, 108-110(1974). (In Italian).

The behaviour of clementines during storage at 23°C and 70% R. H. after gamma irradiation with 0, 50, 100 and 150 krads was studied. The parameters taken into consideration (weight loss, rot percentage, relative incidence of the individual kinds of rot) show on the whole that there are favourable prospects for extending the storage life of this interesting citrus fruit by irradiation. (auth)

17355 STUDIES ON THE RADIATION TREATMENT OF ANIMAL FEED. Muenzner, R. (Institut fuer Strahlentechnologie, Karlsruhe, Ger.). Zentralbl. Bakteriol., Parasitenkd., Infektionskr. Hyg., Abt. I: Orig. Reihe B.; 1: 588-592(1974). (In German)

Total microbial counts and viable fungi were determined in 106 different samples of commercial feeds for small animals. Viable fungi were found in 70 samples, and these were irradiated with electrons, applying a dose of 500, 750 or 1000 krad. After irradiation, viable fungi were observed in 10 of the samples irradiated with 750 krad and in none of the samples irradiated with 1000 krad. (auth)

17356 NICKEL-59 EXCITATION SOURCE FOR X-RAY FLUORESCENCE ANALYSIS OF CARBON AND LOW ALLOY STEELS. Gehrke, R. J.; Helmer, R. G. (Aerojet Nuclear Co., Idaho Falls, ID). X-Ray Spectrom.; 4: No. 2, 77-84(Apr 1975).

The use of ^{59}Ni as an excitation source for the x-ray fluorescence analysis of carbon and low alloy steels has been investigated. ^{59}Ni has a half life of 80,000 y and is essentially a pure source of cobalt K x-rays. It is ideal as an x-ray source for field systems because the encapsulated source is small, rugged and requires no external power or maintenance. The prototype systems require 2.5 minutes to obtain a manganese analysis, and 15 minutes to determine vanadium, chromium and manganese concentrations. These times could be shortened about a factor of 40 with a more intense excitation source and a larger area detector. The feasibility of portable field systems is discussed. (auth)

17357 HAVE ELECTROSTATIC ELIMINATORS GOT TO BE RADIOACTIVE. Dignum, P. H.; Leenhouts, H. P. (Instituut voor Toepassing van Atoomenergie in de Landbouw, Wageningen, Netherlands). Health Phys.; 28: No. 6, 825(Jun 1975).

The experience of a scientist who purchased a commercially available static eliminator in the Netherlands from an importer without either of them realizing that it incorporated a radioactive source (0.5 mCi ^{210}Po) is detailed. In this case, an equally effective and nonradioactive static eliminator was found. It is emphasized that the extra risk of radiological instruments should be balanced carefully against their advantages in comparison with other methods. (UK)

17358 CONSIDERATIONS FOR AN ANALYSIS OF THE VALUE OF POTATO IRRADIATION IN SPAIN. de la Cruz, F.; Ortin Sune, N. (Junta de Energia Nuclear, Madrid). pp 3-11 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The irradiation of potatoes to inhibit sprouting could be of value for the preservation of approximately 50% of the late potato production. The cost of irradiation should be competitive with that of treatment by chemical sprout inhibitors. Considering the present organization and location of the storage units, the use of a fixed irradiator seems inadvisable; it would be better to use mobile irradiators for continuous operation, if possible with conveyor belts. Irradiation of potatoes is of particular interest in the case of potato crisp manufacturers, who have to store the potatoes for a longer period than required in the case of food potatoes. The irradiation process could be of commercial value for the preservation of select varieties, thus furthering the marketing of special products presented in high-quality form. (auth)

17359 UNITED STATES POTENTIALS AND PROBLEMS FOR INSECT DISINFESTATION OF WHEAT AND SPROUT INHIBITION OF POTATOES BY IRRADIATION. Deitch, J. (Dept. of Commerce, Washington, D. C.). pp 13-29 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The production and storage of wheat, wheat flour, and white potatoes in the US are described. Also described are the approved petitions for these foods, and production tests and studies of the products. Public attitude and support for irradiated foods in the US is discussed. (auth)

17360 PREPARATIONS FOR MARKETING IRRADIATED POTATOES AND ONIONS IN THE FEDERAL REPUBLIC OF GERMANY. Diehl, J. F. (Inst. of Radiation Tech., Karlsruhe, Ger.). pp 31-36 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Extensive laboratory studies, wholesomeness tests, consumer trials and experience with storage and processing of irradiated tubers on a semi-industrial scale have set the stage for the general introduction of potato irradiation in the FRG. Advantages of the process are seen primarily in the health field, i.e., irradiation as an alternative to the currently practiced use of chemical sprout inhibitors. Interest in onion irradiation is based more on economic considerations. (auth)

17361 PRESENT STATUS AND PROSPECTS FOR THE COMMERCIALIZATION IN HUNGARY OF IRRADIATED FOOD ITEMS FOR HUMAN CONSUMPTION. Farkas, J. (Central Food Research Inst., Budapest). pp 37-59 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Research in Hungary on the irradiation of potatoes, onions and mushrooms and the present status of approval by the health authorities are summarized. The results of two economic feasibility studies, based on the assumption of the establishment of irradiation plants in Budapest, are described. The factors hindering commercialization of radiation techniques in Hungary and the conditions of the acceleration of this process at home and abroad are discussed. (auth)

17362 PETITIONS AND CLEARANCES FOR IRRADIATED FOOD ITEMS: IMPLEMENTATION OF LEGISLATIVE REQUIREMENTS IN MARKETING TESTS. Eisenberg, E.; Foa, E.; Lapidot, M.; Padova, R.; Rosenberg, K.; Ross, I. (Soreq Nuclear Research Centre, Yavne, Israel). pp 61-68 of Requirements for the Irradiation of food on a commercial scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Formulation of legislative requirements regarding irradiated food items and their implementation are basic steps in a commercialization campaign of such products. The petitions for clearance of irradiated vegetables in Israel are discussed in the light of the attitude of the Ministry of Health to the matter and the corresponding procedures adopted in the formulation of the petitions. The regulations issued by the Ministry on food items preserved by irradiation are reviewed, as are the clearances of irradiated potatoes and onions. The legislative requirements regarding actual irradiation and storage for marketing of the products and the means and procedures adopted to implement these requirements in a series of test marketing periods are presented. Some conclusions are formulated to guide planners of irradiated-food commercialization campaigns. (auth)

17363 IRRADIATION TREATMENT FOR SPROUT INHIBITION IN POTATOES: PROSPECTS FOR APPLICATION IN BELGIUM. Schietechatte, W.; Nys, L. (INACOL Inst., Wezembeek-Oppem, Belgium). pp 69-87 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 May 1974). See STI/PUB-394; CONF-740371-.

In the present situation, taking into account both the knowledge of gamma radiation and of treatments based on Propham-Chlorpropham and legislation and the needs of commerce, there cannot be any question of advocating in Belgium a policy of investment aimed at the setting up of an installation on an industrial scale. Nevertheless, there would be interest in conceiving a pilot installation, for which two modes of application would have to be compared, i.e., gamma radiation and electron accelerators. Such a pilot installation would entail above all development work on the adequate handling and processing of treated tubers, which is basically a problem of agricultural engineering. (auth)

17364 PROSPECTS OF ONION IRRADIATION IN INDIA. Sudarsan, P. (Dept. of Atomic Energy, Bombay). pp 89-112 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The economic feasibility of reducing post-harvest losses of onions by a sprout-inhibiting dose (6 krad) of gamma radiation is discussed with special reference to a promising location. India is a major onion producing and exporting country. Significant losses due to sprouting, rotting and dehydration during storage and transportation constitute a serious problem. Laboratory and field storage trials showed that storage losses may be reduced considerably by irradiation. A transportation trial indicated that consignments dispatched by rail, involving long transit periods to distant consumption centers in winter, may similarly benefit from radiation treatment. Analyses of production seasonality, price fluctuations and likely monetary benefits to farmers and traders show that onion irradiation may induce storage in larger quantities for longer periods, and increase dispatches to distant markets within the country and abroad. Analysis of demand for onion irradiation in a promising location showed that a commercial irradiator could be operated for eight consecutive months at about 50% capacity utilization, con-

sidering only the demand for internal consumption. On this basis a preliminary cost-benefit analysis showed that high returns on investment may be expected for the economy as a whole and for potential entrepreneurs. If onion farmers are to benefit directly from the project, it should preferably be operated as a service irradiator, whose profitability would be less, and certain infrastructural facilities would need be strengthened or provided. Profitability would increase substantially if exports are permitted. The likely impact of an onion irradiator on production, market arrivals, price fluctuations, and on neighbouring village markets is discussed. The socio-economic and commercial factors affecting economic feasibility are detailed. The possible relevance of the study to other developing countries is explained and the need for greater collaboration in all aspects of food irradiation among groups of countries such as developing countries with similar needs, conditions and problems is discussed. (auth)

17365 BACKGROUND TO THE ESTABLISHMENT OF THE FIRST FOOD IRRADIATION PLANT IN JAPAN. Umeda, K. (National Food Research Inst., Tokyo). pp 113-131 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

In 1973 a commercial potato irradiator was established at the Shihoro Agricultural Co-operative Association in Hokkaido, Japan, with a capacity of about 10,000 tons of potatoes per month. The ^{60}Co source, which is approximately 300 kCi, is situated at the center of a circular conveyor system, 5 m in radius, on which the potato containers are loaded. Details of the facility are given. Its establishment was facilitated by the following main factors: (1) sprout inhibition of potatoes by irradiation fitted well into the proposed new Japanese system for the distribution of fresh agricultural produce; (2) the establishment of a research group to collect all the necessary data; (3) general consumers have recognized the safety of irradiation treatment, especially in view of the present problems of chemical residues in agricultural products and foods in Japan; and (4) the Agricultural Co-operative Association, which was in charge of the plant organization, had a great deal of technical expertise, thus understanding the implications of radiation treatment, and also aimed well-timed propaganda at the farmers. (auth)

17366 COMMERCIALIZATION OF IRRADIATED POTATOES, MUSHROOMS, ONIONS, AND SPICES IN THE NETHERLANDS. de Zeeuw, D. (Instituut voor Toepassingvan van Atomenergie in de Landbow, Wegeingen, Netherlands). pp 133-139 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

After a brief description of the Dutch public health regulatory approach to food irradiation, the results of technological feasibility and consumer acceptability studies carried out on potatoes, onions and mushrooms at Wageningen are reviewed. It is suggested that international agreement on the philosophy and guidelines of the testing for wholesomeness of irradiated food be worked out. (auth)

17367 PREPARATION FOR THE INTRODUCTION OF FOOD IRRADIATION IN BRAZIL. Zonenschain, L. (Brazilian Food Irradiation Programme (APIA), Rio de Janeiro). pp 141-153 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

In the course of the Brazilian Food Irradiation Program studies on the radiation inhibition of sprouting of potatoes and onions, the disinfestation of rice, beans, maize, wheat and coffee, and the prolongation of the shelf-life of some fruits have been carried out. Economic feasibility calculations indicate that large total benefits could be achieved by the introduction of food irradiation. The Brazilian legislation on irradiated foods is described and an action plan for commercialization suggested. (auth)

17368 STATEMENT OF THE WHO REPRESENTATIVE ON THE WHOLESOMENESS OF IRRADIATED FOODS. Sentici, M. (World Health Organization, Vienna). pp 157 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The World Health Organization is particularly concerned about the safety and wholesomeness of irradiated food items. The Joint FAO/IAEA/WHO Expert Committee on the Wholesomeness of Irradiated Food with Special Reference to Wheat, Potatoes and Onions, which met in Geneva in 1969, (TRS No. 451) recommended clearance of irradiated potatoes and wheat on a temporary basis only, because the available data were still insufficient for a permanent clearance to be recommended. (TFD)

17369 PUBLIC ACCEPTABILITY OF FOOD IRRADIATION. Propsti, G. (EURISOTOP Office, Brussels). pp 159-166 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

More forceful action by the proponents of food irradiation is advocated. Both verbal and physical actions are proposed. (TFD)

17370 NOTES ON THE FOOD IRRADIATION PROGRAMME IN ITALY WITH PARTICULAR REFERENCE TO POTATOES. Baraldi, D. (CSN, Rome). pp 167-174 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Research on food irradiation carried out at the Casacci Nuclear Center is briefly illustrated. Recent legislation approved by the Italian Ministry of Health, which allows the commercialization and public consumption of irradiated potatoes, onions, and garlic is presented. Some considerations on the economic and technological problems in the program are discussed. (TFD)

17371 PREPARATIONS FOR COMMERCIALIZATION OF IRRADIATED FOODS IN THE CZECHOSLOVAK SOCIALIST REPUBLIC. Horacek, P. (Czechoslovak Atomic Energy Commission, Prague). pp 175-178 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Plans to introduce irradiated potatoes and onions to the Czechoslovakian market are briefly described. (TFD)

17372 STATUS OF THE FOOD IRRADIATION PROGRAMME IN ISRAEL. Lapidot, M. (Soreq Nuclear Research Centre, Yavne, Israel). pp 179 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Research on food irradiation in Israel is briefly described. Marketing tests on irradiated potatoes and onions are being conducted. (TFD)

17373 POSSIBILITIES AND PROBLEMS OF INTRODUCING RADIATION PRESERVATION OF FOODSTUFFS IN URUGUAY. Merino, F. G. (National Atomic Energy Commission, Montevideo). pp 181-182 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The work done in Uruguay has been concentrated on the inhibition of sprouting in potatoes by means of gamma irradiation. The National Atomic Energy Commission has been carrying out a multi-stage program since 1972. Experiments aimed at inhibiting sprouting in onions and at disinfestation of wheat were started in 1974, but since these experiments are relatively recent, the summary presented relates only to potatoes. (auth)

17374 STATUS OF POTATO IRRADIATION IN FRANCE. Sandret, F. (Ecole Nationale Superieure des Industries, Massy, France). pp 183-184 of Requirements for the Irradiation of Food on a Commerical Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The food irradiation program in France is briefly reviewed. Irradiated potatoes is the only food that has been authorized for sale. (TFD)

17375 POTATO AND ONION IRRADIATION IN THE NETHERLANDS. Sparenberg, H. (Inst. for Storage and Processing of Agricultural Produce, Wageningen, Netherlands). pp 185-195 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The potato industry in the Netherlands is reviewed. Research on radiopreservation of potatoes and onions is reported. (TFD)

17376 ECONOMIC FEASIBILITY OF ONION, POTATO, AND WHEAT IRRADIATION IN INDIA. Sudarsan, P. (Dept. of Atomic Energy, Bombay). pp 197-201 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

The potato, onion, and wheat crops of India are briefly reviewed. The application of radiopreservation to these crops is discussed. (TFD)

17377 CONSUMER ATTITUDES TOWARDS FOOD IRRADIATION IN THE NETHERLANDS. van Kooij, J. G. (Inst. for Atomic Sciences in Agriculture, Wageningen, Netherlands). pp 203 of Requirements for the Irradiation of Food on a Commercial Scale. Vienna; International Atomic Energy Agency (1975).

From panel on the commercialization of irradiated food items accepted for human consumption; Vienna, Austria (18 Mar 1974). See STI/PUB-394; CONF-740371-.

Results of a nation-wide survey of 670 Netherland housewives regarding radiopreservation of foods are summarized. The survey consisted of 11 questions which can be divided into the following categories: familiarity with the process of irradiation and irradiated products; opinion on food irradiation; buying of irradiated food; and willingness to co-operate in product testing. (TFD)

17378 APPLICATION OF INDIUM-113m FOR MEASUREMENT OF DEGREE OF MIXING, 8. Suppositories. Tanno, K.; Uemura, K. (Research Inst. of Brain and Blood Vessels, Akita (Japan)); Imai, A. Yakugaku Zasshi; 94: No. 11, 1389-1392 (Nov 1974). (In Japanese).

An examination was made on the method for determination of the optimal melting temperature at which the mixture of main active ingredients and a base is poured into molds for preparing suppositories by the fusion method. The mixture was prepared by labeling zinc oxide with $^{113m}In \cdot Fe(OH)_3$, and mixing it with cacao butter, and distribution of zinc oxide was determined from radioactivity. Distribution of the active ingredient in mixtures melted at 40 to 60° showed a coefficient of variation not higher than 1.0% immediately after cessation of stirring and about 2.5% 5 min later. Coefficient of variation of the active ingredient was higher 10 min after cessation of stirring and thereafter, when the melting temperature was higher. Further, the higher the melting temperature, the larger was the difference in the content of the active ingredient between the upper and bottom layer of the mixture. In the mixture melted at 40°, virtually no difference was noted in the content of the active ingredient between the upper and bottom layers even 50 min after cessation of stirring, but in the mixture melted at 60°, there was about two-fold difference in the content between the two layers 30 min after cessation of stirring and about 3-fold difference 50 min later. From these data, a method was established which would permit rapid determination of the distribution of active ingredients in a mixture of active ingredients and a base. (auth)

17379 PROPOSED EXTENSION OF EXISTING RESEARCH AGREEMENT FOR COOPERATION BETWEEN THE UNITED STATES AND ISRAEL CONCERNING CIVIL USES OF ATOMIC ENERGY. House of Representatives, Ninety-Fourth Congress, First Session, February 13, 1975. Washington, DC; Joint Committee on Atomic Energy (1975). 11p. GPO.

The Joint Committee on Atomic Energy considered H. Con. Res. 114, a resolution expressing the approval of the Congress of the amendment to the 1955 "Agreement for Cooperation Between the Government of the United States of America and the Government of Israel Concerning Civil Uses of Atomic Energy" proposed by the Atomic Energy Commission on January 14, 1975, and with this document reported the resolution without amendment and recommended that it pass. (TFD)

LIFE SCIENCES

Radiation Effects on Biochemicals

Refer also to abstracts 16768, 17423, 17425, 17428, 17520, and 17523.

17380 EFFECTS OF IONIZING RADIATIONS ON THE ACTIVITY OF VALYL-tRNA SYNTHETASE ISOLATED FROM THE RAT LIVER AND MORRIS HEPATOMA 7777. Romano, M.; Cerra, M.; Salvatore, M.; Onorati, A. (Inst. of Tumors, Naples). Tumori; 60: No. 4, 301-306(1974). (In Italian).

The effects of x radiation on the activity of valyl-tRNA synthetase (L-valine tRNA ligase) from rat liver and Morris hepatoma are reported. The results showed that: the enzymatic activity is strongly inhibited by radiations; the enzymatic inactivation is much more marked in dilute than in concentrated solutions; the inactivation of enzyme is linked to oxidation of sulfydryl groups indispensable to the catalytic activity of the enzyme; and no substantial difference in relation to inactivation by radiation was observed between rat liver and Morris hepatoma enzymes. (auth)

17381 RADIATION DAMAGE IN STAINED CATALASE AT LOW TEMPERATURE. Glaeser, R. M.; Hobbs, L. W. (Univ. of California, Berkeley). J. Microsc. (Oxford).; 103: 209-214(Mar 1975).

Radiation damage, which occurs in the beam of the electron microscope, was studied in uranyl acetate stained catalase crystals. Damage is observed in terms of the disappearance of higher orders of the electron diffraction pattern. The damage at very low specimen temperatures proceeds both more rapidly and to a greater final degree than is the case at room temperature. (auth)

17382 NUCLEIC ACIDS: INTERACTION WITH SOLAR UV RADIATION. Murphy, T. M. (Univ. of California, Davis). Curr. Top. Radiat. Res.; 10: No. 3, 199-228(Jun 1975).

Atmospheric pollutants that reduce the amount of ozone in the stratosphere may markedly increase the flux of intermediate-wavelength solar ultraviolet (uv) radiation that reaches the earth's surface. Like short-wavelength germicidal uv radiation (<280nm), these intermediate uv wavelengths (280 to 315nm) can promote photochemical reactions in nucleic acids, leading to the appearance of such products as cyclobutadipyrimidines and single and double strand breaks. These photochemical reactions strongly affect the biological activities of the nucleic acids. Computer techniques are now available for predicting the chemical and biological effects of increased in vitro irradiation of purified nucleic acids. However, the effect of increased uv irradiation in vivo is complicated by the presence of sensitizing agents in cells and by the action of nucleic acid repair processes. There is strong evidence that in vivo damage to nucleic acids injures irradiated cells and tissues, but further research is needed to predict quantitatively the physiological consequences of increases in solar uv. (NL)

17383 USE OF THE PARAMAGNETIC LABEL METHOD FOR STUDYING THE CONFORMATIONAL CHANGES IN DNA ON ULTRAVIOLET IRRADIATION. Mil', Ye. M.; Zhil'tsova, V. M.; Kruglyakova, K. Ye. (Inst. Khimicheskoj Fiziki, Moscow). Biophysics.; 19: No. 4, 611-614(Jun 1975).

The kinetics of conformational changes in the local-denatured regions of DNA molecules formed on exposure to ultraviolet radiation were studied. Change in the parameter I_0 reflected the general process of degradation of DNA while change in the parameter τ_c reflected a conformational rearrangement in the local-denatured regions of the macromolecule. The character of the dependence of τ_c on the dose for three concentrations was apparently due to the different degrees of aggregation of the macromolecules. (auth)

17384 INHIBITORY EFFECT OF UV-IRRADIATION ON THE FORMATION OF TWISTED CIRCULAR LAMBDA DNA. Tokunaga, F. (Kyoto Univ., Japan). Int. J. Radiat. Biol.; 27: No. 3, 237-245 (Mar 1975).

Ultraviolet irradiation of λ phage resulted in an inhibition of conversion of λ DNA in host cells from the initial linear form to twisted circular form. The formation of open circular λ DNA in vitro (formation of Hershey's circle) was quite resistant to the irradiation. The occurrence of denaturation by ultaviolet irradiation was detected in λ DNA. (auth)

17385 CHAIN REACTIONS AND RADIOSENSITIZATION: MODEL ENZYME STUDIES. Redpath, J. L.; Willson, R. L. (Mount Vernon Hospital Northwood, Eng.). Int. J. Radiat. Biol.; 27: No. 4, 389-398(Apr 1975).

The influence of persulphate ions on the radiosensitivity of dilute aqueous solutions of ribonuclease and lysozyme was studied under a variety of conditions. Rate-constants for reactions of the sulphate radical, $SO_4^{\cdot-}$, with a variety of solutes and transient product spectra of some of these reactions are reported. The presence of persulphate ions in general enhanced the radiation sensitivity; in nitrous oxide-saturated persulphate solution, a chain reaction was demonstrated. (auth)

17386 MUTANT OF ESCHERICHIA COLI K12 DEFICIENT IN THE 5′-3′ EXONUCLEOLYTIC ACTIVITY OF DNA POLYMERASE I. General Characterization. Glickman, B. W.; van Sluis, C. A.; Heijneker, H. L.; Roersch, A. (Rijksverdedigingsorganisatie TNO, Rijswijk, Netherlands). pp 20-33 of Role of DNA Polymerase I in the Repair of Ultraviolet Light Induced Damage in Escherichia Coli. Glickman, B. W. (ed.). Rijswijk; Rijksverdedigingsorganisatie TNO (28 Nov 1973).

The general characteristics of a DNA polymerase I mutant of Escherichia coli, which was discovered in a search for mutants unable to replicate 32P β damaged bacteriophages λ are outlined. The mutant retained the DNA polymerizing activity of polymerase I but it lacks the 5′-3′ exonucleolytic activity. The mutation was denoted as polA107. (NL)

17387 STUDIES ON DNA REPAIR IN BACILLUS SUBTILIS. II. Partial Purification and Mode of Action of an Enzyme Enhancing the Prime Activity of γ-Irradiated DNA. Noguti, T.; Kada, T. (National Inst. of Genetics, Mishima, Shizuoka, Japan). Biochim. Biophys. Acta; 395: No. 3, 294-305(Jul 1975).

A cellular factor that makes T7 DNA irradiated with γ rays a better primer for Micrococcus DNA polymerase was partially purified by DEAE and phosphocellulose column chromatography and named primer activating enzyme. Sucrose density gradient sedimentation analysis was carried out to examine actions of one major active fraction that appeared by phosphocellulose chromatography. It was shown that this factor introduced new nicks in T7 DNA in addition to those introduced directly by γ irradiation. This enzyme fraction also had an endonucleolytic activity towards DNA containing apurinic sites induced by heat treatment and had capacity to enhance the priming activity of heat or methyl methansulfonate-treated DNA but affected very little that of ultraviolet-irradiated DNA. This enzyme had no effect on T7 DNA when it was not treated with the DNA-damaging agents. From these results it was concluded that this enzyme may be analogous to the endonuclease II or apurinic site-specific endonuclease of Escherichia coli. (NL)

17388 STUDIES ON DNA REPAIR IN BACILLUS SUBTILIS. I. A Cellular Factor Acting on γ-Irradiated DNA and Promoting Its Priming Activity for DNA Polymerase I. Noguti, T.; Kada, T. (National Inst. of Genetics, Mishima Shizuoka, Japan). Biochim. Biophys. Acta; 395: No. 3, 284-293(Jul 1975).

Initiation of DNA synthesis was observed in B. subtilis cells on γ irradiation followed by toluene treatment and incubation in the presence of the four deoxynucleotide triphosphates and Mg^{2+}. This DNA synthesis took place in the absence of ATP and was refractory to 6-(p-hydroxyphenylazo)-uracil which is a specific inhibitor for the type III polymerase of Bacillus subtilis. This repair-type DNA synthesis was greatly reduced in mutant cells deficient in DNA polymerase I. Restoration of transforming activity of cellular DNA was found to occur in parallel with the above repair type DNA synthesis. A protein factor that enhances the priming activity of γ irradiated DNA for DNA polymerase I was detected in DNA-free extracts prepared from B. subtilis cells by means of lysis with a buffer containing lysozyme, Brij-58 and EDTA. (NL)

17389 ANALYSIS OF THE BREAKING SITES IN THE PHYSICAL DEGRADATION OF DNA. Bertazonni, U. (Institut de Biologie Moleculaire, Paris). Biochim. Biophys. Acta; 395: No. 3, 239-245(Jul 1975).

The 3′-termini of procaryotic and eucaryotic DNA fragments obtained by shearing, sonication, and irradiation were analyzed. Analysis of the 3′-ends of DNA fragments was done by ^{32}P-labeling with terminal transferase, hydrolysis of products by spleen DNAase and spleen exonuclease and separation of labeled 3′-terminal nucleotides on polyethyleneimine plates. In the case of sonication the deviation from DNA base composition of 3′-terminal nucleotides is very close to random for Escherichia coli and Haemophilius influenzae DNA, whereas for calf thymus, mouse and yeast mitochondrial DNAs a significant increase in dA and decrease in dC was observed. Shearing at high salt released random 3′-termini in E. coli DNA and 3′-termini with 4 to 6% deviation from base composition in calf thymus DNA. In the case of

γ-irradiation, no real differences have been found between E. coli and calf thymus DNA and 3'-terminal nucleotide composition is very close to random. Mechanical breakage of eucaryotic DNA seems to release 3'-termini having a composition that differs slightly but significantly from the average base composition of the DNA. (NL)

17390 REPAIR OF ^{32}P DECAY-DAMAGED PHAGE LAMBDA IN VARIOUS RADIATION-SENSITIVE STRAINS OF E. COLI K12. Glickman, B. W.; Walker, K. J.; Roersch, A. (Rijksverdedigingsorganisatie TNO, Rijswijk, Netherlands). pp 64-69 of Role of DNA Polymerase I in the Repair of Ultraviolet Light Induced Damage in Escherichia Coli. Glickman, B. W. (ed.). Rijswijk; Rijksverdedigingsorganisatie TNO (28 Nov 1973).

A number of isogenic radiation-sensitive strains of E. coli K12 were tested for their ability to reactivate ^{32}P β-damaged λ phage. The loss of the Rec, Uvr, Exr, and Ror functions does not affect the reactivation of the damaged phage. In contrast, the loss of the Pol function reduces the reactivation efficiency. It is estimated that polAl strain is five times less efficient in the repair of single-strand DNA breaks than the pol^+ strain. (NL)

17391 INFLUENCE OF RADIATIONS ON THE PROPERTIES OF MELANINS OF PENICILLIUM CULTURES. Chebotarev, L. N.; Zemlyanukhin, A. A. (Voronezh State Univ., USSR). Mikrobiologiya; 42: 845-847(1974).

Translated from Mikrobiologiya; 42: No. 5, 845-847(1973).

The properties of melanin-like pigments from the mycelium of Penicillium glaucum and Penicillium roqueforti were investigated in connection with the influence of visible light and uv rays on the fungi. Under the action of high-intensity uv rays on alkaline solutions of melanin, its oxidation was observed, accompanied by a decrease in the absorption in the short-wave portion of the visible spectrum. Under a prolonged influence of short-wave visible light and uv rays with an intensity of 0.7 $\mu W/cm^2$ on the fungi, the melanin of the mycelium is partially converted to an oxidized form. The oxidized and reduced forms of melanin can undergo a reversible interconversion. (auth)

17392 EFFECT OF SATURATION AS JUDGED BY THE POWER OF THE MICROWAVE FIELD FOR THE PARAMAGNETIC CENTRES OF PROTEINS IRRADIATED WITH ULTRAVIOLET. Aripov, T. F. (A. N. Uzbekskoj SSR, Tashkent. Inst., Yadernoj Feziki); Aripova, D. F.; L'vov, K. M. Biophysics.; 19: No. 3, 445-448(1974).

It is known that in proteins on exposure to ultraviolet radiation, paramagnetic centres (p.c.) of different types appear. In studying the nature of these p.c. and their reactions by the method of electron paramagnetic resonance (EPR) it is necessary to take into account the effect of saturation of the power in the EPR absorption. The effect of this saturation for various p.c. of proteins irradiated with ultraviolet was investigated. (auth)

17393 PROPHAGE INDUCTIVE EFFICIENCY OF ALKYLATING AGENTS AND RADIATIONS. Hussain, S.; Ehrenberg, L. (Stockholm Univ., Sweden). Int. J. Radiat. Biol.; 27: No. 4, 355-362(Apr 1975).

The prophage-inducing efficiency in E. coli K-12 (λ) of a number of agents, alkylating agents and radiations, was compared at a high survival of bacteria. The inducing effectiveness (per alkylation in DNA) and efficiency (compared with mutation frequency in E. coli Sd-4) was found to decrease in the order 2-hydroxyethylating agents (2-hydroxyethyl methanesulphonate and ethylene oxide) > isopropyl methanesulphonate ≈ methyl methanesulphonate > ethylating agents (diethyl sulphate, ethyl methanesulphonate). The low inducing activity of the ethylating agents could not be explained with respect to their reactivity towards targets of differing nucleophilicity, nor could the effectiveness in mutagenicity or the ability to break the chromosomes in the presence of metal ions be invoked. The high inducing efficiency of hydroxyalkylating agents may be related to their ability to break DNA strands. (auth)

17394 BREAKS INDUCED IN SUPERCOILED COLICINOGENIC FACTOR E1 DNA AS RESULT OF THE DECAY OF INCORPORATED TRITIUM. Kupersztoch-Portnoy, Y. M.; Helinski, D. R. (Univ. of California, La Jolla, San Diego). Biochim. Biophys. Acta; 374; No. 3, 316-323(Dec 1974).

The supercoiled DNA form of the colicinogenic factor E1, labeled with tritiated thymidine, was stored at −25°C and aliquots examined periodically for breaks in the DNA. The majority of the breaks were single-stranded and took place in the labeled strand of the DNA. Double-stranded breaks due to the tritium disintegration occurred at about one-sixth the efficiency for single-stranded breaks. The formation of alkaline-sensitive bonds as a result of the tritium decay was not observed. (NL)

17395 EFFECT OF γ IRRADIATION ON DEOXYRIBONUCLEOPROTEIN AS A TEMPLATE FOR RNA SYNTHESIS. Hayashi, M.; Kobayashi, T.; Yoshii, G. (Hokkaido Univ., Sapporo). Biochim. Biophys. Acta; 366: No. 3, 288-291(Oct 1974).

The effect of ionizing radiation on calf thymus DNA and deoxyribonucleoprotein which served as a template for RNA synthesis was investigated in the absence or presence of Ca^{2+}. In the absence of Ca^{2+}, the template activity of calf thymus deoxyribonucleoprotein was decreased by γ irradiation at a dose lower than 5 krads, whereas the template activity increased with a dose range from 10 to 30 krads and decreased again at a dose higher than 30 krads. In the presence of Ca^{2+}, the increase of the template activity by γ irradiation occurred at much lower dose than in the absence of Ca^{2+}. When Ca^{2+} was added to the DNA solution, no change of the dose-effect curve of the template activity could be observed, compared with pure DNA. The results are consistent with the interpretation that the increase of the template activity of deoxyribonucleoprotein is caused by the labilization of deoxyribonucleoprotein into the DNA and the protein on irradiation. (NL)

17396 PHOTOREACTIVATION OF TEMPLATE ACTIVITY OF UV-IRRADIATED DNA IN AN RNA-POLYMERASE SYSTEM. A Rapid Assay for Photoreactivating Enzyme. Piessens, J. P.; Eker, A. P. M. (Technische Hogeschool, Delft, Netherlands). FEBS (Fed. Eur. Biochem. Soc.) Lett.; 50: No. 2, 125-129(Feb 1975).

Ultraviolet irradiation of a DNA template diminishes the ribonucleotide incorporation by RNA-polymerase. The main effects found are a lowering of the total RNA synthesis by production of shorter RNA chains and a decrease of the polymerization rate. It was postulated that cyclobutane-type pyrimidine dimers, which are induced by the action of ultraviolet light on DNA, are important lesions since they are thought to act as transcription terminating sites. Part of the reduction of template activity can be photoreactivated with DNA photoreactivating enzyme and visible light. This finding resulted in a simple assay for photoreactivating activity, which is much more rapid than the commonly used Haemophilus influenzae transformation assay. (NL)

17397 X-RAY-STIMULATED INCORPORATION OF ^3H-THYMIDINE TRIPHOSPHATE INTO DNA OF TOLUENIZED BACILLUS SUBTILIS. Billen, D.; Hellerman, G. R. (Univ. of Tennessee, Memphis). Biochim. Biophys. Acta; 361: No. 2, 166-175(29 Aug 1974).

X-ray exposure of Bacillus subtilis strains made permeable to nucleoside triphosphates by toluene treatment stimulates a repair-type DNA synthesis and inhibits semiconservative DNA synthesis. The x-ray stimulated repair-type synthesis is primarily due to polymerase I activity, since a mutant lacking polymerase I showed a greatly reduced response. The observed x-ray response requires the presence of the four deoxyribonucleoside triphosphates and ATP for full expression. Following irradiation, the DNA synthesized in Pol^+ cells appeared to consist of longer runs than the DNA observed in Pol^- cells. (NL)

17398 FATE OF ULTRAVIOLET-INDUCED PYRIMIDINE DIMERS IN THE MITOCHONDRIAL DNA OF SACCHAROMYCES CEREVISIAE FOLLOWING VARIOUS POST-IRRADIATION CELL TREATMENTS. Waters, R.; Moustacchi, E. (Institut du Radium, Paris). Biochim. Biophys. Acta; 366: No. 3, 241-250(Oct 1974).

The photoreactivability of ultraviolet-induced pyrimidine dimers (pypy) in the mitochondrial genome of stationary phase Saccharomyces cerevisiae has been investigated in conjunction with the fate of these photoproducts following post-irradiation dark incubation in saline and nutrient media. In all instances petite induction and survival were measured. Such pypy are directly photoreactivable, and although they do not appear to be removed from mitochondrial DNA on dark liquid holding, an extensive degradation of mitochondrial DNA was observed. (NL)

17399 MOLECULAR MECHANISMS INVOLVED IN DNA REPAIR. Hanawalt, P. C. (Stanford Univ., CA). Genetics, Suppl.; 79: 179-197(Jun 1975).

From 13th international congress of genetics. Part II; Berkeley and Davis, CA (20 Aug 1973).

The principal mechanisms for DNA repair that have been proposed are reviewed. Several aspects of the excision-repair made as studied with bacterial systems are discussed. The most commonly studied lesion in DNA is the pyrimidine dimer induced by ultraviolet light. This lesion is used as a model. The role of DNA polymerase I and other polymerases and macrotopology of excision repair are considered. (MCG)

17400 ESR EVIDENCE FOR THE RADIATION-INDUCED BREAKAGE OF THE SUGAR-PHOSPHATE BONDS IN NUCLEOTIDES: SINGLE CRYSTAL OF DEOXYCYTIDINE 5'-MONOPHOSPHATE. Krilov, D.; Herak, J. N. (Institut Rudjer Boskovic, Zagreb). Biochim. Biophys. Acta; 366: No. 4, 396-401(Nov 1974).

Electron spin resonance was used for the identification of radicals in the gamma-irradiated single crystal of deoxycytidine 5'-monophosphate monophosphate monohydrate. From the number and angular dependence of the proton couplings the $=C(4')-\dot{C}(5')-H_2$ (5') radicals were identified. These radicals are formed by the breakage of the sugar-phosphate bond. (INIS)

Radiation Effects on Cells

Refer also to abstracts 17432 and 17471.

17401 (BNWL-1950(Pt. 4), pp 60-76) RADIATION DOSIMETRY AND RADIATION BIOPHYSICS. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Theoretical modeling and experimental testing on Chinese hamster (CH) cells were directed at understanding the variation of radiosensitivity during the mitotic cycle. Also, theoretical work on time-dependent effects continued; theoretical analysis and experimental measurements for split-doses on the green algae, Chlamydomonas reinhardi indicated that oxygen and LET both act on the primary radiation damage mechanisms but do not affect recovery processes. In a search for phenomena that have simple primary physical mechanisms, an experimental search for stochastic effects in the radiation-induced division delay of CH cells was begun. Theoretical development of the theory of LET effects encompassed the disparate behavior of CH cells and C. reinhardi into a single broad pattern consistent with our time-dependent theory. Work on microdosimetry included experimental measurements for fast electrons and Monte Carlo calculations for protons. (auth)

17402 (BNWL-SA-5249) LAJTHA–OLIVER THEORY OF DOSE-RATE AND FRACTIONATION EFFECTS. Roesch, W. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1973. Contract AT(45-1)-1830. 4p. (CONF-750546-1). Dep. NTIS $4.00.

From annual meeting of the Radiation Research Society; Miami, Florida, USA (12 May 1975).

The analytical form of the Lajtha–Oliver theory of dose-rate and fractionation effects on cells is presented. The analytical expression for the theory permits easier comparison with other models and theories. A formula is derived, from Oliver's algorithm, for calculating, from a given high dose-rate survival curve, the survival for lower dose rates and for split doses. Using the analytical expression, the Lajtha–Oliver theory is compared with the Swann–del Rosario theory. (ERB)

17403 (SGAE-2383) INCREASED DNA REPAIR IN SPLEEN CELLS OF M. HODGKIN. Frischauf, H.; Dolejs, I.; Howanietz, L.; Neumann, E.; Tuschl, H.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Nov 1974. 15p. CONF-7410121-1). Dep. NTIS (US Sales Only) $4.00.

From 1st Vienna meeting of the international association for the promotion of clinical and experimental research in medicine; Vienna, Austria (31 Oct 1974).

In spleen cells of control patients and cells of Morbus Hodgkin, DNA-repair after gamma- and uv-irradiation was determined measuring the incorporated 3H-thymidine activity in the DNA. Additionally the ratio of labeled cells compared to non-labeled cells and the grains per cell were evaluated by autoradiographic investigations. DNA-content per cell was measured using pulse-cytophotometry. A significant increase of DNA-repair capacity after gamma-irradiation was found by density gradient centrifugation in alkaline sucrose. The same trend could be shown by investigations of unscheduled DNA-synthesis using autoradiographic method. (auth)

17404 (UCRL-51840) CELL CYCLE PHASE OF NON-DIVIDING CELLS IN AGING HUMAN CELL CULTURES DETERMINED BY DNA CONTENT AND CHROMOSOMAL CONSTITUTION. Yanishevsky, R. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Jun 1975. Contract W-7405-eng-48. 184p. Dep. NTIS $12.25.

Thesis.

Human diploid cell cultures, strain WI-38, have a finite proliferative capacity and have been proposed as a model of biological aging. To identify the cell cycle phase of the nondividing cells, cultures of various ages were exposed to ^{3}HdT for 48 hours to label dividing cells, then the cycle phase was identified for individual cells by one of two methods, and finally, the proliferative status of the same cells was scored by autoradiographic evidence of ^{3}HdT uptake. The methods to identify the cycle phase were: determination of DNA strain content by Feulgen scanning cytophotometry, and determination of chromosome constitution by the technique of premature chromosome condensation (PCC). Preliminary experiments showed the effect of continuous exposure to various levels of ^{3}HdT on cell growth. High levels of ^{3}HdT inhibited cell cycle traverse: the cell number and labeling index curves reached a plateau; the cell volume increased; the cells accumulated with 4C DNA contents and it appeared that they blocked in G_2 phase. This pattern is consistent with a radiation effect. (CH)

17405 PHYSIOLOGICAL AND SPECTROPHOTOMETRIC ANALYSIS OF IRRADIATED TISSUE CULTURE CELLS. Thiessen, G. Prog. Histochem. Cytochem.; 4: 91-189(1972). (In German).

The cytological, cytochemical, genetic, and molecular changes in cultured mammalian cells following exposure to various doses of uv or x radiation are reviewed. New microtechniques available for detailed analysis of radioinduced cell damage discussed include: microspectrophotometry for the determination of intracellular biochemical changes; microscopic methods for the determination of cell population dynamics, chromosomal damage, radiation effects on mitosis, and secondary reactions in cell morphology that occur during colony formation by irradiated cells; and cytophotometric methods for the measurement of the DNA content of living cells during various phases of the cell cycle. (CH)

17406 EFFECT OF CHLORMADINONE ACETATE ON THE INCORPORATION OF S-35 IN FIBROBLASTS OF THE HUMAN CERVIX IN VITRO. Tellez-Martinez, J.; Gallegos, A. J.; Gonzalez-Diddi, M. (Centro Medico Nacional, Mexico City). Arch. Invest. Med.; 5: No. 1, 59-64(1974). (In Spanish).

Small fragments of cervix obtained from a 35 year old woman were cultivated. After the third subculture, endocervical cells were treated with 0.25% tripsin and cultivated in 36 Leighten tubes. In each tube 200,000 cells were spread on. Twenty-four hours later, four groups of eight tubes each were randomly selected and subjected to the following treatments: Cells in culture media with 400,000 dpm of sulfate 35, A. S. (^{35}S) 500 mc/mM; same as above plus 10 μg/ml of chlormadinone acetate (CA); same as B but with 20 μg of CA; and cells in culture media plus 20 μg of CA without ^{35}S. After seven days, cultures were processed for autoradiography. It was observed that CA increases ^{35}S incorporation which was directly related to steroid concentration. (auth)

17407 INFLUENCE OF BLOOD STORAGE IN GLASS OR PLASTIC BOTTLES ON THE INDUCTION OF CHROMOSOMAL ABNORMALITIES BY X-IRRADIATION. Deknudt, G.; Leonard, A.; Decat, G. (CEN, Mol, Belgium). Toxicology; 3: No. 1, 87-90(Jan 1975).

The yield of chromosomal abnormalities was studied in cultured lymphocytes irradiated in vitro after different periods of storage (24, 48, 72 h) in plastic or glass containers. The blood was cultured, under standard conditions, for 48 h immediately after irradiation and 200 to 400 metaphases were examined for severe chromosomal aberrations. Blood stored for 48 and 72 h displayed a higher yield of abnormalities after irradiation than that stored for 24 h. No differences could be discerned in this pattern between blood stored in plastic containers and that stored in glass containers. (NL)

17408 EFFECT OF NEUTRON IRRADIATION ON SEDIMENTATION OF CELLULAR DNA. Schroeder, E.; Magdon, E. (Zentralinstitut fuer Krebsforschung, Berlin). Arch. Geschwulstforsch.; 44: No. 2, 134-139(1974). (In German).

Strand breaks in the DNA of HeLa cells induced by neutrons and ^{60}Co γ rays were investigated by the use of alkaline and neutral sucrose density gradients. Exposure to 10 krads γ rays or 5 krads neutrons results in a shift of the molecular weight distribution to a lower value. When the γ-irradiated cells were incubated at 37°C (30 min) a shift of the peak of broken DNA towards the bottom of the alkaline sucrose gradient was observed. In contrast to it, the neutron-irradiated cells show no such a shift of the sedimentation profiles of DNA in spite of incubation for several hours. (auth)

17409 STUDIES OF THE MECHANISMS OF RADIOSENSITIZATION OF BACTERIAL AND MAMMALIAN CELLS BY DIAMIDE. Watts, M. E.; Whillans, D. W.; Adams, G. E. (Mount Vernon Hospital, Northwood, Eng.). Int. J. Radiat. Biol.; 27: No. 3, 259-270(Mar 1975).

Diamide sensitized bacterial and mammalian cells to radiation by at least two mechanisms. Sensitization of V79-GL1 Chinese Hamster cells was due mainly to a reduction of the survival-curve shoulder, was observed both in oxygen and in hypoxia, and was additive to the sensitization of hypoxic cells by some nitroimidazoles. In contrast, sensitization of the radioresistant organism, Micrococcus sodonersis, which had a pronounced shoulder, was entirely dose-modifying. In a rapid-mix study using Serratia marcescens, two mechanisms of sensitization were identified. After 4 to 40 msec preirradiation contact with Diamide, the enhancement ratio was constant at 1.6; after 10 min contact, it was 2.5. With V79-GL1 cells, no sensitization

occurred in the short time range; likewise none was seen when Diamide was added to bacteria or mammalian cells 4 msec after irradiation. It was concluded that Diamide sensitized by at least two mechanisms, one of which resembled that of the electron-affinic type. (auth)

17410 RADIOSENSITIZATION OF CULTURED MAMMALIAN CELLS BY 5-IODOURIDINE. Kuroda, Y.; Yokoiyama, A.; Kada, T. (National Inst. of Genetics, Mishima, Shizuoka). Int. J. Radiat. Biol.; 27: No. 3, 247-257(Mar 1975).

Radiosensitization of cultured mammalian cells was studied with halogenated pyrimidines, such as 5-iodouridine or 6-chloropurine, that have been shown to promote bacterial cell lethality when combined with gamma-irradiation. When Chinese hamster cells were exposed to gamma rays at acidic pH values and the number of colonies was scored after 6 to 11 days of incubation, many more cells were inactivated in the presence of the drug than in its absence. This may have been due to radiation-induced cytotoxic iodine radicals from the reagent in the case of 5-iodouridine, because the cells were inactivated efficiently only by contact with the previously irradiated drug solution. The toxicity of the irradiated drug solution increased remarkably when the pH shifted to the acidic side. The radiosensitization and the cytotoxic effects of gamma-irradiated drug solution were not found with 6-chloropurine. This may be the first observation on the lethal effect of chemical radicals on mammalian cells, and it was concluded that radiosensitization with 5-iodouridine did not require the drug incorporation into cellular DNA, at least under the conditions adopted in the present studies. (auth)

17411 LUNG-COLONY ASSAY: EXTENSION TO THE LEWIS LUNG TUMOUR AND THE B16 MELANOMA-RADIOSENSITIVITY OF B16 MELANOMA CELLS. Hill, R. P.; Stanley, J. A. (Inst. of Cancer Research, Sutton, Eng.). Int. J. Radiat. Biol.; 27: No. 4, 377-387(Apr 1975).

Experiments are described, which demonstrated that a lung-colony assay could be used to study the viability of unknown cell populations from the B16 Melanoma or the Lewis Lung Tumour. The number of lung colonies formed could be increased by the addition of plastic microspheres to the injected cell suspension or by pre-irradiating the lungs of the recipient mice. The colony technique was used to isolate melanotic and amelanotic cell-lines from the B16 Melanoma, which were found to have different growth-rates. In vitro radiation survival curves for B16 Melanoma cells were also established, and these had parameters in the usual range for mammalian cells. (auth)

17412 RBE-DOSE RELATIONS FOR NEUTRONS AND PIONS. Katz, R.; Sharma, S. C. (Nebraska Univ., Lincoln). Phys. Med. Biol.; 20: No. 3, 410-419(May 1975).

From cellular radiosensitivity parameters and theoretical particle-energy spectra in tissue, of the secondary particles from neutron and negative pion irradiations, RBE-dose relations were calculated. The theoretical results were compared with clinical and radiobiological data for normal tissue, tumors and cells in culture. Formulas for calculation, cellular parameters and the needed properties of equivalent "track-segment bombardments" are given, for several mammalian cells irradiated with pions and with neutrons of several energies. (auth)

17413 DIFFERENTIAL CHROMOSOME SENSITIVITY TO X IRRADIATION AND TO HELIOTRINE IN TWO CELL SYSTEMS FROM THE MARSUPIAL POTOROUS TRIDACTYLUS. Bick, Y. A. E. (Tasmania Univ., Sandy Bay, Australia); Brown, J. K. Cytobios.; 11: No. 42, 81-89(Nov 1974).

A study of the effects of x irradiation and the radiomimetic substance heliotrine was made to compare the individual chromosome sensitivity of lymphocytes of Potorous tridactylus in short term culture and in HPK1 cells, a long established diploid cell line from the same animal. Differences were found between the chromosome sensitivity to x rays in the two cell types. In heliotrine-treated cultures, the X chromosome sustained greater damage per unit length than any of the autosomes. The X of HPK1 cells was damaged significantly more than the X of Potorous lymphocytes. The constitutive heterochromatic region of the long arm of X in HPK1 cells was found to be five times more sensitive than the same region in the X of lymphocytes. This increased sensitivity of the X chromosome in HPK1 cells could be due to the fact that this cell line had an exceptionally long DNA synthetic phase, which is the period during which the alkaloid heliotrine is known to produce most of its damage. (auth)

17414 UV SENSITIVE SUBCLONES INDUCED IN AND SELECTED FROM HeLa S3 CELLS. Klimek, M.; Sevcikova, P.; Vlasinova, M. (Inst. of Biophysics, Brno). pp vp, Paper 332 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

Cells of the clone HeLa S3 were treated with 5-bromodeoxyuridine and after its incorporation and the cells were irradiated with visible light. Clones resulting from surviving part of this population were isolated and after several weeks irradiated with uv light (254 nm). A wide spectrum of survival curves was found among survivors. Some of them were very sensitive ones and a few of them were more resistant than the original clone. The resistant subclones were polyploid. Among the sensitive subclones which do not differ in ploidy from HeLa S3 clone, there were subclones with the sensitivity not changed during the interval of several months. However, some of the subclones showed a gradual decrease in the radiosensitivity, coming closer to the survival curves of the original clone HeLa S3. Among the stable subclones there was the subclone 46. DNA synthesis in the cells of this subclone, after irradiation with a dose of 100 or 200 ergs per mm^2 respectively, shows a rapid inhibition in the first hour after irradiation. In later hours there was a much more pronounced recovery of the DNA synthesis in the irradiated cells of HeLa S3 clone, than in the subclone 46. Recovery of DNA synthesis was still more pronounced in $^{18}/_{2}$, one of the resistant polyploid subclones HeLa S3. (HLW)

17415 PHOTOREACTIVATION OF UV-IRRADIATED CARCINOMA CELLS IN MICE. Chatterjee, R.; Chakraborty, A.; Roy, D. (Chittaranjan National Cancer Research Centre, Calcutta). pp vp, Paper 333 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

Suspensions of ascites carcinoma cells from adult male Swiss mice in isotonic saline were irradiated with uv irradiation at 2600 Å for 15 minutes and for subsequent photoreactivation, cells were exposed to visible light at 5300 Å for 30 minutes. For DNA and RNA synthesis tritium labelled thymidine and uridine respectively were added in the cell suspension and kept for one hour after which smears were taken on glass slided for microautoradiography. For cytochemical staining of protein[2], parallel cell suspensions were also kept for one hour without adding any isotope and smeared on glass slided. Each experiment was performed in a temperature controlled room at 28°C. For observing the occurence of photoreactivation, smears from three groups of unradiated control, uv radiated and photoreactivated cells were compared. Besides Ehrlich's carcinoma cells, photoreactivation of methylcholanthrene induced skin cancers of Swiss mice was studied by preparing whole cell suspensions in isotonic saline from solid tissues with the help of stainless steel mesh. Results show that DNA synthesis was strongly inhibited by uv radiation and in photoreactivated cells DNA synthesis was not repaired showing absence of direct photoreactivation or nonomerization of pyrimidine dimers. RNA synthesis was however, strongly inhibited by uv radiation but in photoreactivated cells RNA synthesis determined by grain counts was observed to increase slightly. Cytochemical staining for protein when compared with normal control cells showed that after uv irradiation most of the cells became oedematous and their protein contents dimished to great extent. (HLW)

17416 INHIBITION OF DEOXYRIBONUCLEIC ACID TRANSCRIPTION BY ULTRAVIOLET IRRADIATION IN MAMMALIAN CELLS: DETERMINATION OF THE TRANSCRIPTIONAL LINKAGE OF THE 18S AND 28S RIBOSOMAL RIBONUCLEIC ACID GENES. Hackett, P. B. Jr. Boulder, CO; Univ. of Colorado (1974). 215p. University Microfilms Order No. 74-22,347.

Thesis (Ph. D.).

The inhibition of deoxyribonucleic acid (DNA) transcription in mammalian cells by ultraviolet irradiation has been studied. The reduction in the rates and the amounts of total ribonucleic acid (RNA) synthesis and of 18S, 28S, and 45S ribosomal RNA (rRNA) synthesis, in tissue cultured mouse L cells, were examined as functions of ultraviolet dose and time after ultraviolet irradiation. Total RNA synthesis in the ultraviolet irradiated L cell was found to decrease as a function of ultraviolet dose. The rates of synthesis for the 18S and 28S rRNAs and the 45S precursor RNA decreased exponentially with ultraviolet dose; the respective D_{37} values were 310 erg/mm^2, 130 erg/mm^2, and 90 erg/mm^2. Ultraviolet inactivation kinetics of rRNA synthesis in HeLa cells indicated that, as in L cells, each 45S rRNA transcriptional unit has its own promotor, and that the 18S rRNA cistron is promotor proximal and the 28S rRNA cistron is promotor distal. All of the above findings support the hypothesis that irradiation of mammalian cells with ultraviolet light causes the formation of lesions on the DNA templates which result in premature termination of transcription. (ERB)

17417 HUMAN DISEASES WITH GENETICALLY ALTERED DNA REPAIR PROCESSES. Cleaver, J. E. (Univ. of California,

San Francisco); Bootsma, D.; Friedberg, E. Genetics, Suppl.; 79: 215-225(Jun 1975).

From 13th international congress of genetics. Part II; Berkeley and Davis, CA (20 Aug 1973).

DNA repair of single-strand breaks (produced by ionizing radiation) and of base damage (produced by ultraviolet (uv) light) are two repair mechanisms that most mammalian cells possess. Genetic defects in these repair mechanisms are exemplified by cells from the human premature-aging disease, progeria, which fail to rejoin single-strand breaks, and the skin disease, xeroderma pigmentosum (XP), which exhibits high actinic carcinogenesis and involves failure to repair base damage. In terms of the response of XP cells, many chemical carcinogens can be classified as either x-ray-like (i.e., they cause damage that XP cells can repair) or uv-like (i.e., they cause damage that XP cells cannot repair). The first group contains some of the more strongly carcinogenic chemicals (e.g., alkylating agents). XP occurs in at least two clinical forms, and somatic cell hybridization indicates at least three complementation groups. In order to identify cell lines from various different laboratories unambiguously, a modified nomenclature of XP lines is proposed. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 17351, 17355, 17391, 17396–17398, 17438, 17458, and 17459.

17418 (AD-778681) SELECTION OF THE GRISEOFULVIN PRODUCER "PEN. NIGRICANS THOM" THROUGH THE ACTION OF MUTAGENIC FACTORS. Kommunarskaya, A. D. 1975. Translated by F. W. Koolbeck from pp 41-42 of Nauchno-Issledovatelskii Institut Antibiotikov. Konferentsii Molodykh Uchenykh Leningradskogo Instituta Antibiotikov 2-Y, Leningrad, 4–5 June 1964, Materialov. (CONF-640636-1; FTD-HT-23-965-74). 6p. NTIS $3.00.

From conference of young scientists of the Leningrad Institute of Antibiotics; Leningrad, USSR (4 Jun 1964).

Through the use of mutagenic factors and selection a new variant of the griseofulvin producer was obtained, the strain 52-beige. On the average its activity on a medium with corn flour exceeds the activity of the initial strain 964 by 25%. The span of variability in terms of antibiotic formation is somewhat less for sublines of the 52-beige strain than the span of variability of strain 964; the corresponding coefficients of variability are 44% and 52%. A total of 150 sublines of the 52-beige strain were studied in depth conditions on a medium with corn flour. Considerable variability was noted with respect to antibiotic formation. (GRA)

17419 EFFECT OF GAMMA IRRADIATION ON THE STORAGE LIFE OF CLEMENTINES. Magaudda, G. (CNEN, Rome). Ind. Conserve.; No. 2, 108-110(1974). (In Italian).

The wholesomeness of the citrus fruit, clementine during storage at 23°C and 70% R.H. after gamma irradiation with 0, 50, 100, and 150 krads, was studied. The parameters taken into consideration (weight loss, rot percentage, relative incidence of the individual kinds of rot) show on the whole that there are favorable prospects for extending the storage life of this interesting citrus fruit by irradiation. (auth)

17420 RADIOSTERILIZATION. Horakova, V. (Statni Vyzkumy Ustav Textilni, Liberec, Czech.). Farm. Obz.; 43: No. 6, 261-264(1974). (In Czech).

A brief survey is presented of the industrial application of ionizing radiation in the sterilization of medical and surgical products. The irradiation plant in operation in Czechoslovakia is briefly described. (auth)

17421 EAST COAST FEVER: ^{60}Co-IRRADIATION OF THEILERIA PARVA IN ITS TICK VECTOR, RHIPICEPHALUS APPENDICULATUS. Purnell, R. E. (ARC Inst. for Research on Animal Diseases, Compton, Eng.); Brown, C. G. D.; Burridge, M. J.; Cunningham, M. P.; Emu, H.; Irvin, A. D.; Ledger, M. A.; Njuguna, L. M.; Payne, R. C.; Radley, D. E. Int. J. Parasitol.; 4: No. 5, 507-511(1974).

Three experiments were carried out in which Theileria parva was irradiated in its tick vector, Rhipicephalus appendiculatus. In the first experiment, infected unfed adult ticks were irradiated at doubling doses from 4 to 32 krad. Some of the ticks were then fed for 4, 5, 6, 7 and 8 days on rabbits, and the parasites in their salivary glands examined. Five male and 5 female ticks from each irradiation dose were put onto each of a pair of susceptible cattle, whose reactions were recorded. Increasing doses of irradiation resulted in progressive destruction of the parasites. All cattle receiving ticks irradiated at doses up to and including 16 krad died of East Coast fever (ECF), and one of the cattle receiving ticks irradiated at 32 krad died. In the second experiment, recently engorged nymphs were irradiated at 1,2 or 4 krad, and moulting nymphs at doses of 2, 4, 8, 12, 16 or 32 krad. The salivary glands of the resultant adult ticks were examined after the ticks had fed for 4, 5, 6, 7 or 8 days on rabbits. Engorged nymphs irradiated at 4 krad failed to moult, whilst moulting nymphs irradiated at 32 krad moulted but failed to attach to rabbits. Doses of irradiation survived by the ticks had no apparent morphological effect on the parasites they contained. In the third experiment, infected unfed adult ticks were irradiated at 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 or 60 krad. The ticks were fed on rabbits for 5, 6 or 7 days. Some of them were then examined morphologically, whilst others were ground in MEM/BPA and aliquots of the supernatant used to inoculate groups of 5 cattle. The reaction of these cattle, together with the morphological examination of the parasites, suggested that increasing doses of irradiation destroyed increasing numbers of parasites. (auth)

17422 TWO MECHANISMS OF NEAR-ULTRAVIOLET LETHALITY IN SACCHAROMYCES CEREVISIAE: A RESPIRATORY CAPACITY-DEPENDENT AND AN IRREVERSIBLE INACTIVATION. Fong, F.; Peters, J.; Pauling, C.; Heath, R. L. (Univ. of California, Riverside). Biochim. Biophys. Acta; 387: No. 3, 451-460(Jun 1975).

Near-ultraviolet irradiation of actively growing yeast cells leads to cell death by two distinct mechanisms. The first type of cell death is evident after low doses of near-ultraviolet light (3×10^4 erg mm^{-2}) and is due to a reversible inactivation of the respiratory capacity of the cell. In studies with yeast mitochondrial membranes, the quinones were identified as the site of inactivation by determining the relative levels of the following oxidase activities after irradiation: exogenous NADH, endogenous NADH (via isocitrate dehydrogenase), succinate, and D-lactate oxidases. A second type of cell death is caused after high doses (1.8×10^5 erg mm^{-2}) and is irreversible. The mechanism of this inactivation is unknown. (NL)

17423 PROGRESS IN PHOTOBIOLOGY. Proceedings of the Sixth International Congress, Bochum, Germany, August 21–25, 1972. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974). vp. (CONF-720854-). Max-Planck-Institut fuer Kohlenforschung, Muelheim, Germany.

Separate abstracts were prepared for 11 papers presented at the Congress. An additional 361 papers were presented on various aspects of photobiology. (HLW)

For abstracts of individual papers see: 17414, 17415, 17424–17427, 17448, 17449, and 17478–17480.

17424 SPECIFIC MODIFICATION OF PHOTOREVERSIBILITY OF ULTRAVIOLET-INDUCED SUPPRESSOR MUTATIONS IN ESCHERICHIA COLI. Witkin, E. M. (Rutgers Univ., New Burnswick, NJ). pp vp, Paper 016 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

Three auxotrophic substrains of E. coli B/r were used, all of which owed their auxotrophy to an ochre or amber nonsense codon, and all unable to excise pyrimidine dimers from their DNA because of a uvr mutation. Mutations to prototrophy (primarily ochre and amber suppressors) and to streptomycin resistance were scored in the same irradiated populations, using methods previously described with minor variations. Cultures were irradiated with uv at a dose of 10 ergs per mm^2, and then plated on two kinds of agar: one permitting active protein synthesis (to promote the derepressed state of t-RNA-coding genes), the other inhibiting protein synthesis (to repress t-RNA-coding genes). These plates, along with appropriate dark controls wrapped in foil, were exposed to visible light (PRL) for two to fifteen minutes. Maximum photoreversal under the conditions used required about ten minutes. The bacteria were then harvested by washing each plate, and the wash fluids were assayed to determine viable titers and induced mutation yields. The two series were treated differently only during the period of exposure to PRL: all operations and media used after harvesting the bacteria from the PRL-exposed plates were the same. Uv-induced suppressor mutations (both ochre and amber) were photoreversed more efficiently and to a significantly greater final extent when protein synthesis was inhibited during the PRL exposure than when conditions during PRL exposure permitted active protein synthesis. No difference in the final extent of photoreversal was observed for mutations to streptomycin resistance, scored in the same populations by either of two methods. It is concluded that the efficiency of photoenzymatic repair of pyrimidine dimers is not necessarily the same in different genes at the same time; that altering conditions during PRL exposure can affect the efficiency of photoenzymatic repair differentially in different genes, and that the repressed state of t-RNA-coding genes favors their repair by photoreactivating enzyme, as well as by excision enzymes. (HLW)

17425 PHOTOADDITION OF PROTEINS AND OTHER MOLECULES TO NUCLEIC ACIDS. Smith, K. C. (Stanford Univ., CA). pp vp, Paper 017 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

In a cell, DNA is in intimate contact with proteins, ribonucleic acids, lipids, carbohydrates and small molecule precursors and metabolites. Uv radiation readily induces the chemical addition of amino acids and other compounds to DNA. Such photochemical addition reactions between DNA and other compounds would be expected to have an adverse effect upon cell survival. The uv-induced cross-linking between DNA and protein has been shown to play a major role, under certain experimental conditions, in the killing of uv-irradiated cells. More attention should be given to these addition reactions in trying to explain the biological effects of uv radiation, especially when such effects cannot be adequately explained by the presence of photoproducts that are produced in pure DNA. Since many of these addition reactions to DNA are also induced by ionizing radiation, the same considerations obtain for understanding the biological effects of ionizing radiation. (HLW)

17426 COMPARISON BETWEEN HOST-CELL REACTIVATION AND T4-MEDIATED V-GENE REACTIVATION IN UV-IRRADIATED PHAGE T1. Harm, W. (Univ. of Texas, Dallas). pp vp, Paper 125 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

Uv-irradiated T1 was reactivated even in excision repair-defective cells (E. coli B_{s-1}) by superinfection, after 10 minutes adsorption, with heavily uv-irradiated T4 at a multiplicity of about 1. At doses ranging from about 3000 to 6000 ergs mm^{-2}, a considerable fraction of the T4 permit propagation of T1 in the mixedly infected cells, while their v-gene function is still little affected. Variation of the uv dose applied to T4 before superinfection showed that even unirradiated T4 can provide conditions for vR of T1; however, the absolute level of T1 survival is relatively low because of extensive exclusion by T4. On the other hand, doses beyond about 6000 ergs mm^{-2} lower the effectiveness of T4 in promoting vR of T1, probably because of functional inactivation of the v-gene (and perhaps related genes). The decrease in effectiveness corresponds to a uv sensitivity of about 1.5%, compared to that of T4 as a plaque former. The most striking differences between HCR and vR of T1 have been found in their responses to various repair inhibitors. Caffeine at a permanent concentration of 2 mg/ml, or acriflavine at 3 μg/ml, inhibit HCR completely, but affect little, if at all, vR of either T1 or T4. Also irradiation of the host cells prior to infection with doses up to 1440 ergs mm^{-2} inhibits HCR of T1 much more strongly than vR of T1. However, even a much heavier irradiation of the host cells does not at all affect vR of T4. T1 survival was also investigated under conditions where both the bacterial and the T4-mediated excision repair systems were potentially present. For this purpose, T1 in E. coli B/r cells were superinfected with T4 at a multiplicity around 5. The relative T1 survival was slightly higher than without T4 superinfection, but the slope of the curve was unchanged. In the presence of caffeine a considerable part of the reactivation effect remained, indicating a strong contribution of vR. (HLW)

17427 PROPHAGE- AND UV-REACTIVATION OF UV-IRRADIATED PHAGE. Blanco, M.; Devoret, R. (C. N. R. S., Gif-sur-Yvette, France). pp vp, Paper 134 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

Firstly, experiments were conducted on prophage-reactivation. They were aimed at evaluating, in this recombinational process, the role of various phage and bacterial genes as well as the extent of homology between phage and prophage. Secondly, to test whether uv-reactivation of phage λimm434 was dependent upon recombination between the phage and cellular DNAs, hosts rendered lysogenic for λind⁻ were employed. Such hosts had thus as much DNA homologous to the infecting phage as can be attained. Uv- and prophage-reactivation could therefore be measured separately or simultaneously by choosing non lysogenic or lysogenic hosts either exposed to uv-light or not. Up to 65% of the lethal lesions can be repaired equally well by prophage-reactivation in pyrimidine dimer excision proficient or in deficient strains. Uv-reactivation gives similar results. This indicates that both reactivation processes operate on pyrimidine dimers left unexcised which, by their presence, may trigger repair processes leading to their elimination. The recA13 and lex-1 mutations are both known to suppress uv-reactivation. In contrast prophage-reactivation is strongly decreased by recA13 but quite unaffected by lex-1. In the absence of the $recA^+$ function, the red^+ but not the int^+ function can substitute to $recA^+$ to produce prophage-reactivation, although less efficiently. Prophage-reactivation is highly dependent upon the number of prophages in the cell and upon their degree of homology to the infecting phage. The presence in a recA host of two prophages either in cis (on the chromosome) or in trans (on the chromosome and on an episome) increases the efficiency of prophage-reactivation. (HLW)

17428 SIXTH INTERNATIONAL CONGRESS ON PHOTOBIOLOGY, BOCHUM, GERMANY, AUGUST 21–25, 1972. Book of Abstracts, Symposia and Contributed Papers. Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974). vp. (CONF-720854- (Absts.)). Max-Planck-Institut fuer Kohlenforschung, Muelheim, Germany.

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972).

More than 400 papers were presented at the congress. Abstracts of these are included. (HLW)

17429 X-RAY-STIMULATED INCORPORATION OF [^{3}H] THYMIDINE TRIPHOSPHATE INTO DNA OF TOLUENIZED BACILLUS SUBTILIS. Billen, D.; Hellermann, G. R. (Univ. of Tennessee, Oak Ridge). Biochim. Biophys. Acta; 361: No. 2, 166-175(29 Aug 1974).

X-ray exposure of Bacillus subtilis strains made permeable to nucleoside triphosphates by toluene treatment stimulates a repair-type DNA synthesis and inhibits semiconservative DNA synthesis. The x-ray-stimulated repair-type synthesis is primarily due to polymerase I activity, since a mutant lacking polymerase I showed a greatly reduced response. The observed x-ray response requires the presence of the four deoxyribonucleoside triphosphates and ATP for full expression. Following irradiation, the DNA synthesized in Pol^+ cells appeared to consist of longer runs than the DNA observed in Pol^-cells. (auth)

17430 ELEVATED MUTABILITY OF polA AND uvrA polA DERIVATIVES OF ESCHERICHIA COLI B/r AT SUBLETHAL DOSES OF ULTRAVIOLET LIGHT: EVIDENCE FOR AN INDUCIBLE ERROR-PRONE REPAIR SYSTEM("SOS REPAIR") AND ITS ANOMALOUS EXPRESSION IN THESE STRAINS. Witkin, E. M. (Rutgers Univ., New Brunswick, NJ). Genetics, Suppl.; 79: 199-213(Jun 1975).

From 13th international congress of genetics. Part II; Berkeley and Davis, CA (20 Aug 1973).

The SOS repair hypothesis proposes that uv-induced mutations in E. coli are caused by an inducible error-prone repair system (SOS repair) which is normally induced coordinately with such other $recA^+$ lex^+-dependent functions as filamentous growth, prophage induction and W-reactivation in response to uv or other inhibitors of DNA synthesis. Since polA-1 strains induce these functions at unusually low doses of uv, the SOS hypothesis predicts elevated uv mutability for such strains at these low doses (50 ergs per mm^2 and below) Strain WP6, a polA-1 derivative of B/r, exhibits the predicted high uv mutability in this dose range, producing ten times as many Trp^+ mutations as its $polA^+$ counterpart, strain WP1, at a dose of 12.5 ergs per mm^2. The uv sensitivity of a lex polA double mutant, in which the lex and polA mutations fail to exert their individual effects on uv sensitivity additively, also confirms a prediction generated by the SOS hypothesis. The uvrA polA-1 strain WP67 also shows elevated uv mutability at very low uv doses (5 ergs per mm^2 and below), producing about ten times as many Trp^+ mutations at a dose of 0.6 ergs per mm^2 as its uvrA $polA^+$ parent strain WP2/sub s/. It is proposed that the double mutant induces the SOS repair system (and probably other "reclex" inducible functions) at unusually low doses of uv as a consequence of its relatively inefficient repair of DNA damage when plated on broth-supplemented media. (auth)

17431 QUANTITATIVE VARIATION IN NATURAL POPULATIONS. Parsons, P. A. (La Trobe Univ., Bundoora, Victoria). Genetics, Suppl.; 79: 127-136(Jun 1975).

From 13th international congress of genetics. Part II; Berkeley and Davis, CA (20 Aug 1973).

Quantitative variation is considered in natural populations using Drosophila as the example. A knowledge of such variation enables its rapid exploitation in directional selection experiments as shown for scutellar chaeta number. Where evidence has been obtained, genetic architectures are in qualitative agreement with Mather's concept of balance for traits under stabilizing selection. Additive genetic control is found for acute environmental stresses, but not for less acute stresses as shown by exposure to ^{60}Co-gamma rays. D. simulans probably has a narrower ecological niche than its sibling species D. melanogaster associated with lower genetic heterogeneity. One specific environmental stress to which D.

simulans is sensitive in nature is ethyl alcohol as shown by winery data. (auth)

17432 SYMPOSIUM NO. 15: GENETIC REPAIR. Evans, H. J. (Western General Hospital, Edinburgh). Genetics, Suppl.; 79: 171-178(Jun 1975).

From 13th international congress of genetics. Part II; Berkeley and Davis, CA (20 Aug 1973).

Repair in prokaryotes and eukaryotes following exposure to uv and x radiation is reviewed under the following headings: photoenzymatic repair; excision repair; and post-replication repair. (HLW)

17433 TRANSFER OF THE LAMBDA DV PLASMID TO NEW BACTERIAL HOSTS. Kellenberger-Gujer, G.; Boy de la Tour, E.; Berg, D. E. (Dept. of Molecular Biology, Geneva). Virology; 58: No. 2, 576-585(Apr 1974).

Lambda dv, which was derived from bacteriphage lambda, replicates autonomously as a plasmid in Escherichia coli and consists of only the immunity region (imm/sup lambda/) and DNA replication genes (O,P) of the ancestral phage. Addition phages (lambda imm^{21}-lambda dv) carrying the lambda dv fragment inserted as a tandem duplication in their genome (sequence A imm^{21} O P imm/sup lambda/ O P R) are formed as recombinants after lambda imm^{21} infection of strains carrying lambda dv. Addition phages were used to transfer lambda dv to new bacterial hosts. Lambda dv transfer by excision of the lambda dv segment from the addition phage genome requires a bacterial Rec or a phage Red recombination system. Successful transfer is stimulated by uv irradiation of the addition phage before infection. Some properties of the newly transferred lambda dv plasmids are described. (auth)

17434 SUBLETHAL MUTANTS OF BACTERIOPHAGE T4 AFFECTING RECOMBINATION AND REPAIR OF DNA. Hamlett, N. V. Baltimore, MD; Johns Hopkins Univ. (1974). 144p. University Microfilms Order No. 75-12,948.

Thesis (Ph. D.).

A search was made for sublethal mutants to bacteriophage T4 defective in genetic recombination. $T4D^{+}$ was mutagenized with proflavin, and phage from minute plaques were tested for their sensitivity to ultraviolet (uv) irradiation. Nine uv-sensitive mutants were found. Two exhibit decreased recombination, and the mutations are located in a previously unknown T4 gene-gene w. Seven other minute-plaque-making, uv sensitive mutants exhibit increased recombination; in each of these seven cases, the mutations were found to be in gene 58 (DNA-delay). The newly located gene w maps between genes 24 and 25. Mutants defective in gene w are sensitive to uv and to methyl methanesulfonate. They are also sensitive to hydroxyurea, although they degrade host DNA normally. Incorporation of ^{3}H-thymidine into DNA is normal. A delayed and reduced phage yield appears to be caused by inefficient packaging of DNA in w mutants. This inefficient packaging appears to be caused by failure to form or to maintain a normal complement of concatemeric DNA. Genetic evidence indicates that both 58^{-} and w mutants are defective in the same uv repair pathway as the uv sensitive T4 mutants x and y; none of the double mutants is more sensitive than each of the respective single mutants. Some of these double mutants, however, have cumulative effects on recombination, indicating a more complicated interaction than a discrete unilinear pathway. (ERB)

Radiation Effects on Plants

Refer also to abstracts 16828, 17351, 17401, 17458, 17459, and 17493.

17435 INFLUENCE OF IONIZING RADIATION ON THE ESSENTIAL OILS OF THE GARDEN ROSE. Lata, P. (National Botanic Gardens, Lucknow, India). Parfuem. Kosmet.; 33: 202-203(1974). (In German).

The influence of gamma rays on the essential oil content of cultivated garden roses was examined. In practically all cases the influence of gamma rays reduced the quantity of extracted rose oil. (auth)

17436 CHANGE IN THE REACTION OF WINTER WHEAT CULTIVARS TO A COMPLEX OF PATHOGENES IN CHRONIC GAMMA IRRADIATION. Budanov, V. E.; Lysenko, V. I.; Shcherbakov, V. K. (All-Union Scientific Research Inst. of Plant Growing, Moscow). Dokl. Vses. Akad. Sel'skokhoz. Nauk; No. 3, 19-22 (Mar 1975). (In Russian).

Following chronic gamma-irradiation of wheat plants, their reaction to natural phytopathogenic disease was altered. The emergence in plants of the cultivar Mironovskaya 808, under these circumstances, of anthocyan pigmentation and the lack of this effect in varieties of soft wheat Mironovskaya Jubilee and Bezostaya 1, indicate their genotypical differences in their ability to induce synthesis of anthocyans, which are components of the organism's general protection and recuperation system. The experimental data obtained are of value in predicting changes induced by an increase in the radiation background. (auth)

17437 RADIOPROTECTIVE EFFECTS OF ASCORBIC ACID IN BARLEY SEEDS. Conger, B. V. (UT-AEC Comparative Animal Research Lab., Oak Ridge, TN). Radiat. Bot.; 15: No. 1, 39-48(Apr 1975).

Experiments were conducted to test the radioprotective effects of a naturally occurring reducing agent, ascorbic acid, on seeds (caryopses) of barley, Hordeum vulgare L. emend Lam. Seeds were soaked either before or after gamma or fission neutron irradiation in distilled water or ascorbic acid solutions ranging in concentration from 0.01 to 1.00 M. Results are reported as percentage germination, seedling height, seedling growth reduction, and (in one experiment) percent of cells with chromosome aberrations. As evidenced by both reduced germination and seedling growth, ascorbic acid was toxic when seeds were soaked for 1 hr at ambient temperature prior to irradiation and then planted immediately. When seeds were soaked in ascorbic acid before irradiation and soaked after irradiation in air-bubbled water at 0°C for 18 hr, the toxicity disappeared, and a protective effect (which increased with increasing ascorbic acid concentration) was observed for gamma and, to a lesser extent, for neutron irradiation. Additional studies suggested that the protective effect was related to reduced hydration of the embryos of seeds soaked in ascorbic acid. Also, no radioprotective effect was observed when seeds were presoaked for 2 or 16 hr in 0.01 M ascorbic acid solutions buffered at pH 3 or pH 7. A protective effect was observed for seeds of 1.5 percent water content soaked after irradiation in an oxygen-bubbled ascorbic acid solution of 0.5 M but was not observed for seeds soaked in nitrogen-bubbled ascorbic acid. The protective effect against oxygen-dependent damage may be a result of interaction of ascorbic acid with radioinduced free radicals. (auth)

17438 EFFECTS OF FEEDING IRRADIATED WHEAT TO MALNOURISHED CHILDREN. Bhaskaram, C.; Sadasivan, G. (National Inst. of Nutrition, Hyderabad, India). Am. J. Clin. Nutr.; 28: 130-135(Feb 1975).

Fifteen children suffering from severe protein-calorie malnutrition were divided into three groups of five each and received diets containing either unirradiated, freshly irradiated, or stored irradiated wheat. All the children were hospitalized for a period of 6 weeks and leukocyte cultures were done initially and at intervals of 2 weeks. Children receiving freshly irradiated wheat developed polyploid cells and certain abnormal cells in increasing number as the duration of feeding increased and showed a gradual reversal to basal level of nil after withdrawal of irradiated wheat. In marked contrast, none of the children fed unirradiated diet developed any abnormal cells while children fed stored irradiated wheat showed polyploid and abnormal cells in significantly decreased numbers. Though the biological significance of polyploidy is not clear, its association with malignancy makes it imperative that the wholesomeness of irradiated wheat for human consumption be very carefully assessed. (auth)

17439 CONTRIBUTIONS TO RADIATION STIMULATION. IV. The Influence of Variations in Light and Temperature as Well as Time of Irradiation on Radiation-Induced Growth Stimulation in Lemna Minor L. Feldmann, A. (Kernforschungsanlage, Juelich, Ger.). Radiat. Bot.; 15: No. 1, 49-58(Apr 1975). (In German).

According to the results of the experiments, the radiation-induced growth stimulation in Lemna minor could not possibly have had its origin in the increase in concentration of a single compound or its activation. There was a far more basic alteration of the organism which continued through many subsequent generations. The stimulation effects induced by x-irradiation also could be obtained by even a short-time modification of light and temperature conditions. Presumably the same principle of induction existed in both cases. (auth)

17440 MORPHOLOGICAL STUDIES IN SAFFLOWER (CARTHAMUS TINCTORIUS LINN.) WITH SPECIAL REFERENCE TO THE EFFECT OF 2,4-D AND GAMMA RAYS. I. Vegetative Shoot Apex. Chauhan, Y. S.; Singh, R. P. (National Botanical Gardens, Lucknow, India). Radiat. Bot.; 15: No. 1, 68-77(Apr 1975).

The effects of 2,4-D (10, 50 and 100 ppM) and γ rays (10, 20 and 30 kR), both individually and in combination, were studied on the vegetative shoot apex of safflower. While 2,4-D had no effect on the shoot apex, gamma rays caused much injury. The extent of injury was, however, much less in the shoot tips treated with 10 ppM 2,4-D plus γ ray exposures than in the apices treated with γ rays alone. Occurrence of multinucleate cells and abnormally positioned tracheidal cells was observed in the apices treated with γ rays and 2,4-D plus γ ray combinations. (auth)

17441 MAXIMUM RBE OF FISSION NEUTRONS FOR INDUCTION OF SOMATIC MUTATIONS IN MAIZE. Conger, B. V. (UT-AEC Comparative Animal Research Lab., Oak Ridge, TN). Int. J. Radiat. Biol.; 27: No. 3, 271-281(Mar 1975).

Investigations were conducted to determine the maximum RBE of fission neutrons for the induction of yellow-green sectors in maize. Seeds heterozygous for the yg_2 locus were adjusted to 13 per cent water content, irradiated with varying doses of either fission neutrons or ^{60}Co γ radiation, and soaked for 2 hours in nitrogen-bubbled water at ambient temperature before planting. Frequency of yg_2 sectors, as scored in leaves 4 and 5, increased linearly for both radiations. The RBE values were >1100 at 0.40 sectors per leaf 4 and >600 at 0.20 sectors per leaf 5; however, at these low frequencies, the standard errors were ~3 times greater than the RBE. At 6.0 sectors per leaf 4, the RBE values were 111 ± 9: and at 3.0 sectors per leaf 5, 118 ± 21. As measured by sectors per krad, mutagenic efficiency increased with increased dose of γ-radiation: the opposite was true for fission neutrons. This trend was more evident for leaf 4 than for leaf 5. (auth)

17442 IN VITRO CULTURE OF TOBACCO PROTOPLASTS: SURVIVAL OF HAPLOID AND DIPLOID PROTOPLASTS EXPOSED TO X-RAY RADIATION AT DIFFERENT TIMES AFTER ISOLATION. Galun, E.; Raveh, D. (Weizmann Inst. of Science, Rehovoth, Israel). Radiat. Bot.; 15: No. 1, 79-82(Apr 1975).

Freshly isolated haploid and diploid tobacco mesophyll protoplasts were plated in agar medium and their survival, after irradiation with acute doses of x rays, applied on the day of isolation or on any of three consecutive days was evaluated by scoring their ability to form cell colonies. Survival of diploid protoplasts irradiated on the day of isolation was reduced to about one half by 750 R. This dose-effect is similar to that of plant meristem cells and cultured mammalian cells and rather lower than that reported for plant calli and cell suspensions. The cells showed a relatively low radiosensitivity on the day of isolation which increased drastically in the two subsequent days. On the third day, when most of the cells completed their first karyokinesis, their sensitivity to irradiation was again reduced. (auth)

17443 EFFECTS OF IONIZING RADIATION ON DRIED SPORES OF OSMUNDA REGALIS. Dodd, N. J. F. (Christie Hospital and Holt Radium Inst., Manchester, Eng.); Swartz, H. M. Int. J. Radiat. Biol.; 27: No. 3, 205-210(Mar 1975).

The use of 35 GHz microwave frequency has greatly simplified the separation of overlapping signals in dried irradiated fern spores. While in general having confirmed the conclusions previously drawn from X-band spectra, the use of Q-band has clarified several assignments of radical groups and allowed the recognition of additional radical groups or subgroups. (auth)

17444 INTERRELATION OF EXPOSURE AND EXPOSURE RATE IN GERMINATING SEEDS OF BARLEY AND ITS CONCURRENCE WITH DOSE-RATE THEORY. Bottino, P. J.; Sparrow, A. H.; Schwemmer, S. S.; Thompson, K. H. (Brookhaven National Lab., Upton, NY). Radiat. Bot.; 15: No. 1, 17-27(Apr 1975).

Germinating seeds of barley (Hordeum vulgare "Himalaya") were irradiated with ^{137}Cs gamma rays at various combinations of total exposure (400 to 3200 R) and exposure rate (30 to 24,000 R/hr). Seedling height was measured 5 days after the initiation of irradiation and the various levels of growth inhibition produced by each combination of treatments were determined. The results obtained ranged from no effect on growth to 100% growth inhibition. Growth inhibition curves based on both total exposure and exposure rate were constructed. The exposures required to produce 20 and 35 per cent growth inhibition at each exposure rate were determined, 35 per cent growth inhibition being the highest level that could be determined over the entire range of rates used (20 per cent growth inhibition was used for comparative purposes). For both levels of growth inhibition, as exposure rate increased (or, concomitantly, as exposure time decreased), the total exposure required to produce the end point decreased (effectiveness increased) as a straight line relationship on a double logarithmic plot between 30 and 1500 R/hr (0.03 to 0.3 hr exposure time). Above 1500 R/hr, further increases in exposure rate (or decreases in exposure time) increased the total exposure required for a given effect, i.e., effectiveness decreased. Conversion of exposure rate to exposure time demonstrates this point of change in effectiveness to occur well within one mitotic cycle. These results are discussed with regard to current dose-rate theory and are at least partially consistent therewith. A straight-line dependency of the exposure rate producing maximum growth inhibition on total exposure was shown. The point at which the combinations of exposure and exposure rate for 35 per cent growth inhibition occurred is restricted to barley, and may differ for other species. This may depend on chromosome size or DNA content and/or the mitotic cycle time characteristic of a species. (auth)

17445 CHROMOSOMES AND CELLULAR RADIOSENSITIVITY. IV. New Radiotaxon Represented by the Ferns. Sparrow, A. H.; Howard, A.; Cowie, F. G.; Schwemmer, S. S.; Nauman, A. F. (Brookhaven National Lab., Upton, NY). Int. J. Radiat. Biol.; 27: No. 4, 343-354(Apr 1975).

Survival curves were constructed and D_0 values determined after x-irradiation of single-celled germinating spores of 14 species of ferns, which had a wide variation in interphase chromosome and nuclear volumes and in DNA content per chromosome and per nucleus. A good fit to a line of slope = –1 is given on a log-log plot relating D_0 to interphase chromosome volume. In a previous publication (Sparrow, A. H., Underbrink, A. G., and Sparrow, R. C., 1967, Radiat. Res., 32, 915), ferns fell into radiotaxon VIII, but the new data suggested that they should be assigned to a new group (VIIa) falling midway between radiotaxa VII and VIII. The calculated energy absorption per chromosome at D_0 for VIIa was also intermediate between those for VII and VIII. If the value of this parameter is set at 1 for radiotaxon V, that for VIIa is approximately 32 times greater and the radiotaxa V, VI, VII and VIIa form a series 1 : 4 : 14 : 32. The new results indicated that radiotaxon VIII may have to be abandoned unless some other radiobiologically unexplored group (e.g., algae) fills the gap. (auth)

17446 NON-RANDOM INTRACHROMOSOMAL DISTRIBUTION OF CHROMATID ABERRATIONS INDUCED BY X RAYS, ALKYLATING AGENTS, AND ETHANOL IN VICIA FABA. Rieger, R.; Michaelis, A.; Schubert, I.; Doebel, P.; Jank, H. W. (Akademie der Wissenschaften der DDR, Gatersleben, Ger.). Mutat. Res.; 27: No. 1, 69-79(Jan 1975).

A reconstructed karyotype of Vicia faba with all chromosomes individually distinguishable was treated with triethylene melamine (TEM), cytostasin, mitomycin C, ethanol, and x rays. The distribution within chromosomes of induced chromatid aberrations was non-random for all agents. The number of segments involved in aberration clustering corresponded to the number of sites representing constitutive heterochromatin, or the regions immediately adjacent to these, as evidenced by the position of Giemsa marker bands. Which of these potential regions of aberration clustering reacted with preferential involvement in aberrations was dependent upon the inducing agent used. It is argued that this may be due to differences in the base composition and/or molecular conformation of heterochromatic regions. The distribution pattern of chromatid aberrations induced by mitomycin C was found to be different from those after treatment with the alkylating agents TEM and cytostasin although mitomycin C is assumed to induce aberrations via alkylation. If mitomycin C-induced aberrations are indeed due to alkylation, this indicates that different alkylating agents do not necessarily result in identical patterns of aberration clustering. The other two alkylating agents and ethanol resulted in similar patterns of preferential distribution of aberrations. X-ray induced chromatid aberrations showed a non-random intrachromosomal distribution but the clustering was less pronounced than after treatment with the chemical agents. (NL)

17447 POSSIBILITY OF ESTIMATING THE EFFECT OF SUPERNOVA EXPLOSIONS ON GROWTH OF TREE SPECIES. Lovelius, N. V. (Botanical Inst., Leningrad). Bot. Zh.; 59: No. 7, 992-995(Jul 1974). (In Russian).

The method of analyzing growth rings of trees was used to study possible effects of the supernovae of 1572 (Tycho Brahe), 1604 (Kepler), and 1700 (Cassiopeia A) on tree growth. The growth rings studied were from a juniper at an altitude of 3500 m above sea level, and spanned 807 years. The results show a sharp drop in tree growth immediately after a supernova explosion followed by a thirty-year period before recovery. The growth rate dropped after the supernova, reaching a minimum in the 15th or 16th year before increasing again. Further research is needed to determine the mechanisms responsible for the observed effect. (JPRS)

17448 MUTAGENIC EFFECT OF ULTRA-VIOLET RADIATION ON THE CHLOROPLAST ULTRASTRUCTURE OF CHLAMYDOMONAS REINHARDI. Tageeva, S. V.; Ladygin, V. G.; Semyenova, G. A. (Inst. of Biological Physics, Puschchino, USSR). pp vp, Paper 297 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

The study was aimed at finding an optimum dose of uv-irradiation under which a significant number of cells survived and almost a maximum yield of mutations was reached. Ultrastructure organization of mutants plastids was also studied. A bacterici-

dal lamp BUV-30 with maximum radiation energy in the region of 2537 Å, and capacity of 49 erg/cm² sec. was used as a source of uv-radiation. Irradiation was carried out in a darkened room with the doses from 0,I5.I0⁶ erg/cm² to 2,0.I0⁶ erg/cm². To reveal a protective effect of longwave light (photoreactivation) of the lamps FLW-40, one part of irradiated cells, immediately after being sown at agarized medium, was put to light (experimental version with photoreactivation), the second part was kept in the darkness for 18-20 hours, and only then put to light (version without photoreactivation). For electron microscopic study there were used fixation technique with glutar aldehyde, OsO_4 and subsequent contrasting of ultra-fine sections was carried out with the salts Pb and Ur. Maximum yield of mutations (pigment, morphological and small colonies) were observed under LD_{80} which was in correspondence with the doses of 0.3×10^6 erg/cm² in the version without photoreactivation and of 0.9×10^6 erg/cm² in the version with photoreactivation. (HLW)

17449 PRELIMINARY OBSERVATIONS RELATED TO THE EFFECT OF ULTRAVIOLET LIGHT ON THE FORMATION OF ANTHOCYANIN IN CRESS SEEDLINGS. Vardar, Y.; Baltepe, S. (Ege Univ., Izmir, Turkey). pp vp, Paper 419 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

The germinated seeds of cress were irradiated with a low-pressure mercury vapour ultraviolet lamp. After irradiation the plants were kept in darkness for 42 hours. At the end of this dark period, red pigment production was observed especially in the plumular hooks of the seedlings. It appears that anthocyanin is formed during a dark period after uv irradiation. The fact that red color formation was observed in hypocotyledonary parts although mainly the newly-emerged roots have been irradiated suggests that uv has an after-effect, which is transferable to unirradiated cells, as far as the red pigment production is concerned. (HLW)

17450 SILAGE PRODUCTION AND QUALITY OF PEARL MILLET, SORGHUM, AND CORN HYBRIDS GROWN FROM SEED EXPOSED TO LOW DOSES OF GAMMA RAYS. Burton, G. W. (Agricultural Research Service, Tifton, GA); Monson, W. G.; Hanna, W. W.; Constantin, M. J. Radiat. Bot.; 15: No. 1, 33-38 (Apr 1975).

Just before planting, seeds of pearl millet, Pennisetum americanum (L.) K. Schum., (formerly P. typhoides) hybrid, "Tift 23 X L_1", and corn, Zea mays L., hybrids "Coker 71", "DeKalb 1214", and "Pioneer 3030" were exposed to gamma dosages of 0, 0·15, 0·3, 0·6, 1·2, 2·4, 4·8, 9·6 and 19·2 kR. "FS26" hybrid sorghum, Sorghum bicolor (L.) Moench., seeds were exposed to gamma dosages of 0, 0·2, 0·4, 0·8, 1·6, 3·2, 6·4, 12·8, and 25·6 kR. In one 2-yr. experiment, pearl millet, sorghum, and Coker 71 corn gave respective dry matter yields of 12, 166, 6,993, and 6,306 kg/ha and in vitro dry matter digestibility (IVDMD) percentages of 45·7, 52·8, and 59·9. The heaviest exposures of gamma rays generally reduced yields of all species, and lighter exposures failed to increase yield significantly. Seed irradiation did not affect the quality (IVDMD) of the forage. In a 2-yr. corn hybrid experiment, DeKalb 1214 yielded 24% more dry matter and tolerated the heavy exposures of gamma rays better than Pioneer 3030 and Coker 71. None of the lower exposures increased yield significantly. (auth)

Radiation Effects on Animals

Refer also to abstracts 16828, 17185, and 17735.

17451 LONG-TERM EFFECTS OF IONIZING RADIATIONS IN MAMMALS AND MAN. Goutier, R. (Univ., Liege). Rev. IRE; 1: No. 5, 2-13(Mar 1975). (In French).

By means of experiments the main characteristics of long-term effects of fairly high doses of ionizing radiation on animals are known: shortening of longevity, a higher probability for cancer (mainly responsible for the first effect), and an increased frequency of genetic modifications. Yet very low doses gave no really noticeable effects. However, this very small risk imposes the observation of larger population groups than those examined up until now. Extrapolation to lower doses of the effects observed with higher doses and outputs might even end up in too high estimations; on the one hand the relation dose-effect is seldomly linear and on the other, thanks to a recovery procedure, a radiation dose fractionated or at a low output will provide smaller effects than the same dose given in one time at a high output. Information available about man seems uncomplete and insufficient. With mice a continuous irradiation at a low output (0.009 R/min) for a month and a half, did not cause any modification in the genetic inheritance. If it is evident that the development of nuclear plants requires control and protecting measures whereof engineers and physicists are very much aware, the figures given here do not justify any pessimism towards the influence of this development on public health. Spread over the totality of the population the radiation doses coming from nuclear industries should normally remain inferior to those entailed by medical appliances. (auth)

Man

Refer also to abstracts 17310, 17410, 17566, 18504, 18739, 18742, 18746, and 19119.

17452 (BNWL-1950(Pt. 4), pp 90-95) MEDICAL USES OF ISOTOPES. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Initial tests in goats of the newly developed vitreous carbon-^{170}Tm (VCTm) portable blood irradiator indicate successful and persistent reduction in numbers of circulating lymphocytes. In addition, the cellular immune response, as measured by skin allograft rejection times, is reduced. Changes in design and fabrication techniques are in progress to facilitate further testing and to establish a basis for ultimate clinical use. A study was done to assess the feasibility of developing an economical ^{13}N generator for hospital use. The evaluation was done on the basis of $^{10}B(\alpha,n)^{13}N$ route using $^{241}AmO_2$ as an α source. Lung scanning was considered the goal use. Cost of developing the first two units, licensing and initial check-out was estimated at $1,283,000. Requirements for a $^{13}NH_3$ generating device cannot be assessed without further research into usable chemical/nuclear schemes. (auth)

17453 (BNWL-1950(Pt. 4), pp 101-102) RECIPIENT RADIATION EXPOSURE. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

The objective of this study was to determine the radiation dose from radioisotopic heat sources suitable for circulatory support systems. Computations and measurements were undertaken to form a basis for population dose calculations. The data are presented in terms of average dose rates to a bystander as a function of distance from a recipient. (auth)

17454 (BNWL-1950(Pt. 4), pp 103-105) POPULATION RADIATION EXPOSURE. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

The objective of this project is to develop comprehensive estimates of the radiation dose to the population that would result from successful development and routine use of Pu-238 fueled artificial hearts. The REPRIEVE computer program designed to carry out the calculations and summations necessary to identify the population dose by detailed classifications of heart device recipients and radiation exposure subjects was completed. The basis for projecting future heart disease death rates was revised and the best estimate projection now tracks statistical data remarkably well. A series of REPRIEVE cases were prepared that covered the range of uncertainties in future artificial heart use. Population doses were substantially less than the preliminary estimates reported in the 1973 annual report. Total population dose estimates range from 60,000 to 500,000 rem/yr in the year 2000. (auth)

17455 (CONF-750518-2) COMPARISON OF X-RAY DIAGNOSIS ASSOCIATED RADIATION EXPOSURES IN PUERTO RICO: 1973 VS. 1968. Gileadi, M.; Gileadi, A. E.; Musalem, A. (Puerto Rico Nuclear Center, Mayaguez; Interamerican Univ. of Puerto Rico, San German). 1975. 4p. Dep. NTIS $4.00.

From 3rd European IRPA congress; Amsterdam, Netherlands (13 May 1975).

In general, it can be concluded that comparison of 1973 results obtained to date with parallel values for 1968 show a significant improvement in radiation protection practices in Puerto Rico. This improvement, which concerns the whole of society, is not only a result of technical upgrading of the diagnostic equipment, but also and perhaps more significantly, a result of the utmost efforts of professionals: doctors, radiologists and those in radiation protection, to use diagnostic x-rays judiciously, and to reduce the unavoidable doses to a minimum compatible with the diagnostic objective. (auth)

17456 (DHEW/FDA-75-8022) SURVEY OF MEDICAL RADIUM INSTALLATIONS IN WISCONSIN. Tapert, A. C.; Lea, W. L. (Food and Drug Administration, Rockville, Md. (USA)). May 1975. 36p. U. S. Department of Health, Education, and Welfare, Rockville, MD.

A radiation protection survey was performed at 70 medical radium installations in the State of Wisconsin. The requirements of the State's Radiation Protection Code were used as survey criteria. Radiation measurements of radium storage containers, radium capsule leakage tests, and monitoring of work surfaces for contamination were performed. Film badge monitoring data of whole body and extremity doses are presented for 221 individuals at 17 hospitals. Whole body doses during single treatments ranged from 10 to 1360 mrems per individual. The estimate of 500 mrems per treatment was determined as the dose aggregate to hospital personnel. Whole body doses from film badges are compared with analogous TLD doses. Four physicians and six technicians at nine hospitals participated in a study for monitoring the extremities with TLD. Cumulative extremity doses ranged from 28 to 6628 mrems per participant during the study. (auth)

17457 (DHEW-(FDA)-75-8027) RADIOLOGICAL HEALTH TRAINING RESOURCES, 1975. (Bureau of Public Health, Rockville, Md. (USA). Div. of Training and Medical Applications). 1975. 24p. HEW.

Training materials are listed under the following headings: materials available from the training resources center, materials available from other sources, and materials by subject area. Materials consist of booklets, slides, overhead transparencies, movies, video tapes, and training guides. (HLW)

17458 (EUR-5332-d-e-f-i-n(1)) PROGRAMME BIOLOGY-HEALTH PROTECTION. Annual Report, 1974. I. (Commission of the European Communities, Brussels (Belgium)). 1974. 548p. (In Several Languages). Dep. NTIS (US Sales Only) $30.50. EUR (Vol. I and II) B.F. 1.500.

Summaries are presented of the research projects contracted by the member states of EURATOM. The overall program in biology and health protection includes research in radiation protection (dosimetry, radionuclide transport, hereditary effects, short-term effects, and long-term effects), applications in agriculture (mutagenesis, soil-plant relations, radiation analysis, food conservation, cell cultures, and radioentomology), and applications in medicine (nuclear medicine and neutron dosimetry). This is volume I of a two volume report. For volume II see EUR-5332-d-e-f-i-n-(2). (ERB)

17459 (EUR-5332-d-e-f-i-n(2)) PROGRAMME BIOLOGY-HEALTH PROTECTION. Annual Report, 1974. II. (Commission of the European Communities, Brussels (Belgium)). 1974. 367p. (In Several Languages). Dep. NTIS (US Sales Only) $21.50. EUR (Vol. I and II) B.F. 1.500.

Summaries are presented of the research projects contracted by the member states of EURATOM. The overall program in biology and health protection includes research in radiation protection (dosimetry, radionuclide transport, hereditary effects, short-term effects, and long-term effects), applications in agriculture (mutagenesis, soil-plant relations, radiation analysis, food conservation, cell cultures, and radioentomology), and applications in medicine (nuclear medicine and neutron dosimetry). This is volume II of a two volume report. For volume I see EUR-5332-d-e-f-i-n-(1). (ERB)

17460 (IRI-190-75-05) GENETICALLY SIGNIFICANT DOSE IN MEN CAUSED BY VARIOUS RADIODIAGNOSTIC INVESTIGATIONS IN DUTCH HOSPITALS. Koen, J. A.; Huijskens, C. J. (Interuniversitair Reactor Instituut, Delft (Netherlands). Stralingsbeschermingsdienst). Mar 1975. 68p. (In Dutch).

An attempt to measure the genetically significant dose for men, brought about by eight different diagnostic radiographic investigations in Dutch hospitals, is described. Gonad doses were measured with thermoluminescent dosemeters. There is a considerable spread in gonad dose received by patients undergoing the same investigation in different hospitals. Suggestions are given for methods that decrease both the patient's gonad dose and his total body dose. (NL)

17461 (JAERI-M-5866) HEALTH PHYSICS AND SAFETY IN JAERI, No. 16. (April 1, 1973-March 31, 1974). (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 214p. (In Japanese). INIS. NTIS (US Sales Only) $13.75.

Activities of health physics and safety in the Tokyo Office, Tokai Research Establishment, Takasaki Radiation Chemistry Research Establishment, and Oarai Research Establishment are described. (auth)

17462 (NIRS-AR-16) ANNUAL REPORT OF NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES FOR THE PERIOD FROM APRIL 1973-MARCH 1974. (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1974. 149p. (In Japanese). INIS. NTIS (US Sales Only) $10.50.

The special research subjects "Estimation of the exposure doses due to environmental radiation" and "Estimation of the dangers to the human body by low-level radiation" were begun. Activities in the institute are described in individual summary reports, and publications in the year are listed. (JA)

17463 (SGAE-2333) ROLE OF DNA REPAIR IN VARIOUS HUMAN ILLNESSES. Tuschl, H.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Sep 1974. 19p. (In German). (CONF-7409110-1). Dep. NTIS (US Sales Only) $4.00.

From congress for whole-body medicine of the Federal Association of German Doctors for natural healing methods; Velden, Austria (9 Sep 1974).

The types of DNA damage, their causes, and possible repair mechanisms are briefly reviewed. In human cells only two types of repair are available: dark or excision repair and post-replication or recombination repair. A model for excision repair is given and discussed. Methods available for measurement of DNA repair are summarized. Previously reported data on DNA repair of bone marrow and peripheral lymphocytes in patients after γ irradiation and in healthy controls are reviewed to give a survey of the repair pattern. (JSR)

17464 EARLY REHABILITATION MODEL FOR THE CONTROL FITNESS LIMITING DISEASE DEVELOPMENTS IN PERSONS WITH OCCUPATIONAL EXPOSURE TO RADIATION. Arndt, D.; Schuettmann, W. Z. Gesamte Hyg. Ihre Grenzgeb.; 20: No. 6, 364-367(Jun 1974). (In German).

Preservation of occupational fitness calls for systematic medical measures. The problems involved and the ways and means of solving these are described by the example of occupational exposure to ionising radiation. This example has been chosen for more detailed illumination of the medical, psychological, sociological, and economic aspects of the problem, which include highly specialised activities whose number increases continuously with and parallel to the development of nuclear power. Numerous clearly defined fitness criteria apply to such jobs. These criteria cannot be satisfied by an individual whose general fitness is impaired as a result of a severe chronic disease. (auth)

17465 RECONSTRUCTIVE PLASTIC SURGERY IN RADIONECROSIS OF THE BREAST AND THE THORACIC WALL. Matton, G.; D'Hooghe, P. (State Univ., Ghent). Acta Chir. Belg.; 73: No. 3, 301-318(May 1974).

Two categories of problems are encountered in radionecrosis of the breast and the thoracic wall following radiotherapy: those where the breast is still present and those where a radical mastectomy has been performed. Indications for reconstructive surgery and principles concerning the extent of resection in the periphery and in the depth are identical in both categories. The methods for covering the defect are different. Whereas free skin grafts may be used in selected cases of radionecrosis of the breast, skin flaps are usually necessary in radionecrosis of the thoracic wall. The different methods of coverage are discussed. Our preference goes to adjacent rotation flaps, large sliding abdominal flaps, and the use of the heterolateral breast. The transfer of the greater omentum, covered with split skin grafts, gives excellent results and probably deserves to be used more widely. (auth)

17466 RISK CONSIDERATIONS IN THE USE OF IONIZING RADIATION. Niklas, K. (Krankenpflege; 28: 31-33(Jan 1974). (In German).

The effects of radiation on body tissue are briefly reviewed. The risk which must be taken during diagnostic and therapeutic uses of radiation are evaluated. (JSR)

17467 RADIOTHERAPY OF BREAST CANCER IN THE EARLY STAGES (T_1-T_3). Zucali, R.; Uslenghi, C.; Kenda, R.; Bargellini, A. (Istituto Nazionale per lo Studio e la Cura dei Tumori, Milan). Tumori; 60: No. 4, 279-288(1974). (In Italian).

During 1968 to 1972, 79 patients with breast cancer in the early stages (T_1-T_3) were given radiotherapy after surgery had been excluded on grounds of age, diabetes, cardiocirculatory status, or other contraindication; 69 patients were at stage T_2 and 39 had lymph node involvement. Forty patients received x radiation and 39 received ^{60}Co γ therapy. The five-year survival was 53% and the age-corrected rate 62%, high values considering average age (67 years) and the poor general condition of the patients. Survival was better in the N_0 cases than in those with lymph node involvement (71% compared with 50% at 4 years) and in the over-65s than in the less elderly (77% against 38% at 4 years). Cobalt therapy, preferable to roentgentherapy because treatment is less lengthy and is better tolerated, did not yield better clinical results in terms either of local recurrence or of long term survival. Local recurrences occurred in 13% of patients with a higher incidence at lymph node level than at the primary site. Radiotherapy thus definitely seemed to be effective, even on a long term basis, in early breast cancer, when surgery, radical or conservative, is contraindicated. (auth)

17468 DOSE EQUIVALENT RATE IN THE BASAL LAYER OF THE SKIN FROM ^{241}Am ALPHA PARTICLES. Al-Bedri, M. B.; Harris, S. J. (Surrey Univ., Guildford, Eng.). Health Phys.; 28: No. 6, 816-818(Jun 1975).

The dose equivalent rates at various depths in skin for ^{241}Am deposited on the skin were estimated, based on measurements of range-energy relationships in tissue equivalent materials. Two tissue equivalent gas mixtures and the plastic Melinex, which is frequently used as a convenient approximation to a tissue equivalent solid, were used in these measurements. It is concluded that although the dose equivalent rates presented here are relatively crude estimates, the case for reappraisal of skin contamination limits must now be clear. (UK)

17469 STANDARD SURVEY PROCEDURE FOR PHOTOFLUOROGRAPHIC X-RAY MACHINES. Gaeta, N. A.; Repacholi, M. H. (Bureau of Radiological Health, Winchester, MA). Health Phys.; 28: No. 6, 763-770(Jun 1975).

Over 100 photofluorographic chest x-ray machines in both Canada and the U. S. were surveyed for safety features and operating techniques, as well as determination of patient skin entrance exposure. Using a copper sheet as a standard attenuating medium, the data of all machine surveys were taken at the same exposure parameters or were normalized to the same parameters. A uniform survey technique was then devised so that the relative performance of photofluorographic machines can be easily compared. Data on exposure to human patients vs chest separation and body weight were also accumulated using a transmission ionization chamber. Such data allowed comparisons to be made between exposure from conventional and photofluorographic chest x-ray machines. The relationship between patient skin exposure and exposure to the copper sheet, details of the standard survey procedure, possible sources of machine inadequacy and recommended alterations are also included. (auth)

17470 VALUE OF RADIATION THERAPY IN UTERINE SARCOMA. Gilbert, H. A.; Kagan, A. R.; Lagasse, L.; Jacobs, M. R.; Tawa, K. (Kaiser Foundation Hospital, Los Angeles). Obstet. Gynecol.; 45: No. 1, 84-88(Jan 1975).

Fifty-eight cases of leiomyosarcoma of the uterus and 47 endometrial sarcomas of the uterus are reviewed based on the pertinent information related to recurrence patterns. The following conclusions are made: (1) Cases of endometrial sarcoma should receive preoperative pelvic irradiation, or postoperative pelvic irradiation if a diagnosis is not made until the postoperative period. This plan will probably be of most benefit, if at all, in stage I disease. (2) A case for pelvic irradiation as an adjuvant to surgery in leiomyosarcoma cannot be made from a review of this material, either from a viewpoint at recurrence patterns or radio-responsiveness. (auth)

17471 INVESTIGATION OF THE CHARACTERISTICS OF A NEGATIVE PION BEAM BY MEANS OF INDUCED CHROMOSOME ABERRATIONS IN HUMAN PERIPHERAL BLOOD LYMPHOCYTES. Loyd, D. C. (National Radiological Protection Board, Harwell, Eng.); Purrott, R. J.; Dolphin, G. W.; Reading, D. H. Int. J. Radiat. Biol.; 27: No. 3, 223-236(Mar 1975).

The depth dose profiles of unstable chromosome aberrations were determined by irradiating blood samples at various depths in a plastic phantom exposed to a beam of negative π mesons (pions). The pions were derived from an experimental beam line from the Nimrod 7 GeV proton synchrotron. With a momentum of 160 MeV/c and a spread of 15 per cent a Bragg profile was produced peaking at 13.9 cm. An ionization peak to plateau ratio of 1.6 was obtained and for cytogenetic damage this was increased to 2.9. Dicentric and acentric dose-response data from peak and plateau positions were fitted to $Y = \alpha D + \beta D^2$ models for comparison with data obtained from ^{60}Co gamma rays and fission neutrons. With respect to 150 rads gamma radiation, the RBE values for the pion peak were 2.1 for dicentrics and 2.3 for acentrics. In the plateau the value for both aberrations was 1.5. At pion doses likely to be used as daily radiotherapy fractions, the aberrations predominantly resulted from single-track events, indicating little likelihood of interfraction recovery, particularly in the peak position. The biological damage characteristics of pion beams, as determined from a cytogenetic end-point, offer several features attractive to the radiotherapist. (auth)

17472 CHEMICAL PROTECTION AGAINST IONIZING RADIATION. Vos, O. (Erasmus Univ., Rotterdam). Ned. Mil. Geneeskd. Tijdschr.; 27: No. 5, 203-212(Sep 1974). (In Dutch).

A review is given of research on chemoprotection during the last 25 years. Discovery, working mechanism, and degree of protection are discussed. Examples of agents active by a systemic pharmacological mechanism and at the cellular level are presented. The possibilities of protection in various organs, protection against various types of ionizing radiation, the limitation in the practical application in human beings, and the importance of clinical use are described. It is concluded that no prophylactic agent for a large-scale safe use in human beings has been discovered yet. The data known at present do not preclude further improvement in the development of a protective agent which can safely be used in human beings. (NL)

17473 EXPERIENCE IN THE THERAPY OF MALIGNANT TUMORS OF TONSILS. Rubes, R.; Venclik, H. Cesk. Otolaryngol.; 23: No. 3, 156-160(Jul 1974). (In Czech).

In the years 1950 to 1972, 85 patients with primary malignant tumor of tonsils were treated. Twenty-four of them suffered from carcinoma, 49 epithelial sarcoma, and 12 lymphosarcoma. All the patients were treated by irradiation, first by a deep radiotherapy, followed by telecobalt therapy and most recently by means of electron irradiation using a betatron. In indicated cases the primary tumor was extirpated, in some cases simultaneously with metastases. In sarcomas, also the antitumor chemotherapy proved to be valuable. A five year survival is evaluated in 69 patients. In 20 patients with cancer, 6 patients, i.e., 30% survived 5 years without symptoms of relapse, in 39 patients with reticular sarcoma, 15 patients, i.e., 38.5% survived, and in 10 patients suffering from lymphoblastic sarcoma, 4 patients, i.e., 40% survived a corresponding period of time. On the whole, 25 patients, i.e., 36.3% survived malignant tumors of tonsils for a period of 5 to 22 years. (auth)

17474 CERVICAL SYNOVIAL SARCOMA AT THE BIFURCATION OF THE CAROTID ARTERY. Golomb, H. M.; Gorny, J.; Powell, W.; Graff, P.; Ultmann, J. E. (Univ. of Chicago). Cancer; 35: No. 2, 483-489(Feb 1975).

Cervical synovial sarcoma has been reported in only 15 cases; in none of these was there any association with a vascular structure. A patient with cervical synovial sarcoma encompassing the bifurcation of the left carotid artery underwent a left radical neck dissection, including excision of the left external carotid artery and the hypoglossal nerve. The tumor was dissected away from the common carotid and internal carotid arteries. Although the fibrous pseudo-capsule of the tumor was focally infiltrated by malignant cells it appeared that the tumor had not involved the fibrous adventitia of the carotid arteries. Radiation therapy with 6000 rads tumor dose was administered to a wide local field. There is no evidence of recurrence 1 year postoperatively. Histologic and ultrastructural findings were similar to those reported previously in a case of synovial sarcoma of an extremity. (auth)

17475 LUNG INJURIES DURING RADIOTHERAPY OF BRONCHIAL CANCER. Shapiro, I. B. (Central Scientific-Research Inst. of Roentgeno-Radiology, Leningrad). Sov. Zdravookhr. Kirg.; 4: 30-32(1973). (In Russian).

The occurence of lung injuries as a result of the radiotherapy of bronchial cancers was studied in 215 cases treated by γ or megavolt irradiation. X-ray morphological investigations were made of the lungs. Lung damage was found in 54.8% of the cases. Injury occurs in both apparently unchanged lung tissue and in atelectatic tissue. (JSR)

17476 LATE RESULTS OF THERAPY OF MALIGNANT TUMORS OF TONSIL AREA. Hybasek, I.; Pellant, A. (Karlova Univ., Hradec Kralove, Czech.). Cesk. Otolaryngol.; 23: No. 3, 161-164(Jul 1974). (In Czech).

At the otolaryngological clinic at Hradec Kralove, 111 patients with malignant tumours of the region of tonsils were treated between 1946 and 1972. Men constituted 59% of patients. In 46% of patients was found cancer, in 49% sarcoma, and in 5% a histologically unidentifiable malignant tumour. A statistical examination of the group indicated significantly more frequent cancer in men than in women and an insignificant difference between the sexes in the case of sarcoma. Metastases were detected in 66%. A five year survival was evaluated in 97 patients treated until 1967. Five years and more without symptoms of relapse survived 31 patients, i.e. 32%, of them 16 (32%) with cancer, 13 (31%) with sarcoma and 2 with a histologically unidentifiable tumour. These patients were treated 12 times by irradiation, twice only surgically, and 17 times by a combination of both methods. A statistical examination of a dependence of the results of treatment on the kind of used therapy did not show any advantages of telecobaltherapy in a comparison with orthovoltage roentgen. A comparison of the results of therapy in the years 1946 to 1956 with those in the years 1957 to 1967 revealed an improvement from 24% to 40.5%. (auth)

17477 MODERN TRENDS IN THE RADIOTHERAPY OF HODGKIN'S DISEASE. Mantero, E. (Magenta Hospital, Milan). Minerva Med.; 66: No. 8, 399-404(3 Feb 1975). (In Italian).

The discovery that Hodgkin's disease has a unicentric onset has enabled its prognosis to be modified. In its initial, uniregional stage, in fact, it can be cured by radiotherapy. A satisfactory

result will only be obtained, however, if certain fundamental rules are followed: aggressive treatment with extensive radiation fields, radiation of adjacent lymphatic districts, prior splenectomy where necessary. (auth)

17478 BIOCHEMICAL AND STRUCTURAL EFFECTS OF LIGHT ON THE SKIN. Daniels, F. (Cornell Univ., NY). pp vp, Paper 043 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

The following topics are discussed: use of blue or white light to treat neonatal jaundice in premature infants; hazards of supersonic transport aircraft; relation between skin color and solar radiation; uv-radioinduced erythema; damage to epidermal DNA following uv radiation; role of urocanic acid as absorber of sunburn ultraviolet radiation; radioprotective effects of flavins and vitamin A on DNA; and uv-radioinduced morphological changes in epidermis. (HLW)

17479 DNA SYNTHESIS AND CELL PROLIFERATION IN THE EPIDERMIS FOLLOWING UV-IRRADIATION. Epstein, J. H. (Univ. of California, San Francisco). pp vp, Paper 045 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

Studies on acute and chronic effects of uv radiation are reviewed. Acute exposures result in interruption of the cell cycle and inhibition of DNA, RNA, and protein synthesis in the mammalian epidermis in vivo. This is followed by recovery and acceleration of all of these functions which reaches a peak by 48 to 72 hrs and is associated with epidermal hyperplasia. Progressive epidermal changes induced by chronic irradiation were studied using the hairless mouse model. The changes ranged from benign hyperplasia to invasive squamous cell cancer. A progressive increase in mitoses and DNA synthesis was observed. (HLW)

17480 LYSOSOMAL DAMAGE BY UV-IRRADIATION OF THE SKIN. Johnson, B. E. (Univ. of Dundee, Scotland). pp vp, Paper 046 of Progress in Photobiology. Schenck, G. O. (ed.). Frankfurt am Main; Deutsche Gesellschaft fuer Lichtforschung e. V. (1974).

From 6th international photobiology congress; Bochum, F. R. Germany (21 Aug 1972). See CONF-720854-.

The following topics are reviewed: characteristics of lysosomes; lysosomes in the skin; lysosomes and uv radiation; skin reactions to uv radiation in relation to lysosome damage; and photosensitivity. (HLW)

17481 DYNAMICS OF CHROMOSOME ABERRATIONS AND MITOTIC ACTIVITY IN THE CELLS OF THE HUMAN BONE MARROW AFTER ONE-TIME LOCAL γ IRRADIATION IN A DOSE OF 150 RAD. Neishtadt, E. L.; Simbirtseva, L. P.; Suskov, I. I.; Baranov, A. E. (Scientific-Research Inst. of Oncology, Leningrad). Med. Radiol.; 20: No. 4, 62-63(Apr 1975). (In Russian).

Analysis of the dynamics of different types of chromosome aberrations shows that up to 36 hr after irradiation the single and paired fragments and the chromatid exchanges increase, but decrease sharply at 48 hr. At 36 hr after the irradiation the number of dicentrices with fragments is twice the normal number, which indicates a cell mitosis at the time of irradiation in phase G_1. After 48 hr, dicentric and ring chromosomes without fragments are found, which is typical of the appearance of cells entering into the second mitosis. A sharp drop in the number of aberrant cells in the 48 to 96 hr after irradiation indicates their elimination. (TTT)

17482 MAXIMUM ALLOWABLE DOSE LEVELS OF IONIZING RADIATION. Kimel, L. R.; Mashkovitch, V. P. pp 52-59 of Zashchita ot Ioniziruyushchikh Izluchenii. Moscow; Atomizdat (1966). (In Russian).

This chapter of the handbook presents basic tables and rules dealing with maximum allowable radiation levels, maximum dose rate, relative biological efficiency of various type of radiation, and maximum concentrations for a number of radioactive isotopes. Data are also presented for determining allowable periods of time for staying in various dose fields. This handbook is useful to those working with radioactive substances and sources of ionizing radiation. (tr-INIS)

17483 POSTRADIOTHERAPY MYOCARDIOPATHY. Lupi, E.; Bialostozky, D.; Marcuschamer, J.; Garcia, H.; Soni, J. (Instituto Nacional de Cardiologia, Mexico City). Arch. Inst. Cardiol. Mex.; 44: 487-499(1974). (In Spanish).

A case is presented of a patient who developed clinical manifestations of right side heart failure two years after receiving radiotherapy for a left breast carcinoma. The cardiac catheterization study demonstrated filling insufficiency of the right ventricle. The patient received a dose of ionizing radiation enough to produce cardiac disease. In the absence of a history that could suggest a different etiology it was considered a post-radiotherapy cardiomyopathy. A review of the literature is included. (32 references) (auth)

17484 COMPARISON OF SKIN ERYTHEMAS UNDER TWO DIFFERENT FRACTIONATION SCHEMES. Angelakis, P.; Throuvalas, N.; Paraskevas, G.; Pontifix, G. (Athens Univ., Greece). Br. J. Radiol.; 48: No. 569, 390-391(May 1975).

Results of a prospective clinical trial comparing 200 rads daily five times weekly for four weeks with 400 rads twice weekly for four weeks are reported. Total dose in the first case was 4,000 rads and in the second 3,200 rads. Thirty patients treated palliatively for bronchial carcinoma were involved. Treatment was given at 220 kV and the intensity of skin erythema at the end of the treatment was the measure of comparison. Generally 200 rads daily five times weekly for four weeks produced more intense erythema than the other scheme used. (auth)

17485 A COMPOUND PROCESS TO EXAMINE THE HEART AND LUNG IN ORDER TO ESTABLISH THE EARLY AND LATE RADIOLESIONS BY AN INTRATHORACAL RADIO-TREATMENT. Dossev, G.; Vrantscheva, D. (Meditsinska Akademiya, Sofia (Bulgaria). Centre for Oncology and Hematology). Strahlentherapie; 149: No. 4, 375-377(Apr 1975). (In German).

9 refs.

An electro-physiological compound process to establish the radiolesions in the heart and lung is described. This process contributes to the early exact diagnosis of the permanent and momentary radiolesions. This process would be used by 70 patients with a lymphogranulomatosis and 100 patients with a carcinoma of the mammary glands. Changes in the phases of the systole and the diastole that precede the clinical symptoms, would be observed. (auth)

17486 NUCLEAR MAGNETIC RELAXATION IN THE CELL. Kivinlitty, K.; Koivula, A. (Oulu Univ. (Finland). Dept. of Radiotherapy). Strahlentherapie; 149: No. 4, 402-405(Apr 1975).

3 tabs.; 15 refs.

The authors have measured the proton relaxation times of gynecological cancer. T_1 and T_2 of human tumors are longer than proton relaxation times of corresponding normal tissues. Radiotherapy also changes proton relaxation times T_1 and T_2 in tissue. (auth)

17487 IRRADIATION BLADDER DAMAGE PRESENTING AS INCRUSTED CYSTITIS. Hiratsuka, Y.; Ariyoshi, A.; Ohshima, K.; Fujisawa, Y. (Fukuoka Univ. (Japan)). Nishinihon J. Urol.; 36: No. 5, 585-589(Oct 1974). (In Japanese).

A forty year old house wife developed severe irradiation cystitis following the treatment of carcinoma of the cervix with radical operation and radiation (Linac 4,000 rad). This condition persisted for about 6 months producing numerous incrustations adherent to the bladder mucosa. Urine was always acid through the period and intermittently infected with Escherichia coli. Presence of nocturnal incontinence and residual urine seemed to prove impairment of bladder function. One of the recognized etiologic factors underlying incrusted cystitis is the presence of alkaline urine caused by infection by a urea-splitting organism. However, we emphasize a possibility of occurrence of incrusted cystitis without alkaline urine under the condition of a persistent severe inflammatory lesion accompanied with bladder dysfunction. (auth)

17488 HEAD AND NECK CANCER FOLLOWING THERAPEUTIC IRRADIATION AND A BRIEF REVIEW ON THOSE IN JAPAN. Kikuchi, A.; Watanabe, C.; Abe, M.; Kubota, H.; Idogawa, K. (Tohoku Univ., Sendai (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 34: No. 7, 491-503(Jul 1974). (In Japanese).

Incidence of malignant neoplasms developing after therapeutic irradiation is still being reported. Of these cases, cancer in the head and neck after irradiation has been believed to be comparatively rare, but four such cases experienced and a case of lupus carcinoma arising from the scarred skin irradiated 43 years ago, are summarized herein. A total of 113 cases of malignant neoplasms occurring in the head and neck after radiation therapy have been reported in Japan. Sex and age distribution of these patients is reported. The ages in irradiation cancer of the thyroid are lower than in the standard series of 263 patients operated in our hospital. Interval between irradiation and development of cancer shows that 13 patients irradiated for malignant conditions had short intervals, with an average of 10 years, as compared with patients for benign conditions, with an average of 25 years. Sex and age distribution of 29 cases of lupus carcinoma reported in Japan and the latent period between diagnosis of lupus and

development of skin cancer are shown. Of these, 18 had been previously irradiated. (auth)

17489 PROFESSIONAL RADIATION CANCER IN JAPAN. Kitabatake, T.; Watanabe, T. (Niigata Univ. (Japan). School of Medicine); Koga, S. Rinsho Hoshasen; 19: No. 10, 787-794(Oct 1974). (In Japanese).

Eighty three cases died of professional radiation injury in Japan. However, only 74 cases were selected as subjects because they had materials for study, which consisted of 30 cases with skin cancer, 28 cases with leukemia, 7 cases with aplastic anemia, and other 9 cases. The cases who died of skin cancer were older at the time of death in more recent years. Average latent periods were 22.2 years in the cases with skin cancer, 17.7 years in the cases with leukemia, and 19.1 years in the cases with aplastic anemia, respectively. There was no relationship between the estimated exposure doses and the latent periods. In the cases with skin cancer having more doses for the first 3 years the latent period was shorter and the occurrence of cancer was tendency to be produced in their earlier years. However, these tendencies were not found in the cases with leukemia and aplastic anemia. (JA)

17490 HYPERTHYROIDISM IN THE PRESENCE OF PANHYPOPITUITARISM. Thyroid Crisis and Hypothyroidism Following Radioiodine Treatment. Krishnamurthy, G. T.; Blahd, W. H. (Veterans Administration Wadsworth Hospital Center, Los Angeles). West. J. Med.; 120: No. 6, 491-496(Jun 1974).

Hyperthyroidism developed in a patient eight years after the onset of panhypopituitarism following deep x-ray therapy to a nasopharyngeal tumor invading the pituitary. The patient experienced thyroid crisis five days after radioactive iodine therapy for hyperthyroidism; and, three years later, primary hypothyroidism developed in addition to previously obscure pituitary TSH deficiency. This is believed to be the first such case reported. In the management of this patient, a most unusual sequence of endocrine abnormalities occurred. (auth)

17491 EARLY REPORTS OF X RAY DANGERS. Mazzola, P. V. Bull. Hist. Dent.; 22: 31-34(Jun 1974).

The development of diagnostic radiography is one of the most valuable tools in the diagnosis of medical and dental problems today. This has only been achieved after its destructive and mutating effects on human tissue were recognized, and protective devices were adopted and exposure routines were developed that resulted in making a radiographic examination the relatively safe and simple procedure it is today. It is unfortunate that many of the earlier workers in this field suffered exposure to a degree that led to required amputation of hands and fingers, to malignancies at the sites of exposure, and, in several cases, even to death. But without these intrepid and earnest pioneers in an unchartered course, the tremendous boon to mankind which is the x ray may never have reached its full potential. (CH)

17492 OPERABILITY OF THE IRRADIATED LARYNX. Blavier, A.; Hulet, P.; Dancot, H.; Feremans, W. (Centre Paul Cogniaux, Brussels). Acta Oto-Rhino-Laryngol. Belg.; 27: No. 8, 986-992(1973). (In French).

The surgical techniques followed and the post-operative care given patients for repair of the larynx following radiotherapy of neoplasms are described. No serious problems were encountered and indicate that radiotherapy should be tried first in many cases in order to avoid surgical mutilation. Total laryngectomy in the case of radiotherapy failure does not seem to pose large problems. In 37 patients the only post-operative incident was the appearance in 29% of the cases of a salivary fistula. All these fistulas scarred spontaneously. (JSR)

17493 BIOLOGICAL EFFECT OF ENERGY-RICH RADIATION USED IN MEDICINE. Peters, K. Krankenpflege; 28: 90-92 (Mar 1974). (In German).

The LD_{50} value is defined and tabulated for various animal and plant life in order to illustrate the biological effects of high-energy radiation. The effects of shielding part of the body are then discussed. The relative biological effectiveness of various types of radiation are discussed and it is shown that the biological effects of radiation are a function of the energy, dose, and type of radiation. (JSR)

17494 RADIOTHERAPY OF LYMPHOGRANULOMATOSIS. Musshoff, K.; Slanina, J. (Univ., Freiburg i. B.). Internist; 15: 85-92(Feb 1974). (In German).

The principles of radiotherapy of lymphogranulomatosis are considered from the viewpoint of the illness and from the viewpoint of the dose fractionation schedule for radiotherapy selected. The side effects of radiotherapy are briefly summarized. The methods used for therapy and its results are considered in some detail. Factors affecting the prognosis are tabulated. (JSR)

17495 RESULTS OBTAINED IN CHILDREN WITH ACUTE LYMPOBLASTIC LEUKEMIA IN A PERIOD OF 10 YEARS WITH THE COMBINATION OF POLYCHEMOTHERAPY AND RADIOTHERAPY OF THE CENTRAL NERVOUS SYSTEM. Aur, R. J. A.; Hustu, H. O.; Verzosa, M. S.; Simone, J. V.; Pinkel, D. (St. Jude Children's Research Hospital, Memphis, TN). Sangre; 18: No. 4, 449-454(1975). (In Spanish).

The efficiency of two methods of treating lymphoblastic leukemia in children was compared. One group of children was irradiated cranially with 2400 rads simultaneously with intrathecal methotrexate. The second group received 2400 rads craneospinally. Both methods were highly effective. Although serious infections occurred with equal frequency in both groups, in the three months following craneospinal irradiation it was necessary to modify much more frequently the schedule of chemotherapy because of leuopenia than in the other group of patients. Therefore the cranial irradiation with simultaneous intrathecal methotrexate was considered preferable. (JSR)

17496 PROBLEMS POSED BY THE USE OF IONIZING RADIATION IN DENTAL PRACTICE. I. Reminders of Facts of Radiation Physics. Wambersie, A.; Lejeune, A. Rev. Belge Med. Dent.; 29: No. 1, 3-16(1974). (In French).

The characteristics and production of photons (x rays or gamma rays) and of other types of ionizing radiation are reviewed. The physical concepts of dose and exposure and their corresponding units, the rad and the roentgen, are defined. The concepts of relative biological efficiency (RBE), quality factor (Q), equivalent dose (H), and its unit (rem) are made more precise and their area of applicability is considered. (tr-auth)

17497 PROBLEMS POSED BY THE USE OF IONIZING RADIATION IN DENTAL PRACTICE. II. Radiation Protection in Dental Radiography. Wambersie, A.; Lejeune, A. Rev. Belge Med. Dent.; 29: No. 1, 17-30(1974). (In French).

Radiation protection problems found in dental radiography should not be very important because of the radiation sources used and the regions to be examined. Experience has shown however that doses delivered either to the patient or to the personnel are too frequently higher than the type of examination would justify. The first part of this report is a brief review of the concepts of radiobiology. The second part reviews some aspects of the Belgian legislation on radioprotection. (tr-auth)

17498 PHYSICAL BASES OF ENERGY-RICH RADIATION USED IN MEDICINE. Seeger, W. Krankenpflege; 28: 92-94 (Mar 1974). (In German).

The physical principles of high-energy radiation are briefly outlined. The production of x radiation and the characteristics of radioactive decay are briefly summarized. The uses of radioisotopes in diagnosis and therapy and of x rays in diagnosis are considered. The characteristics of particle irradiation are described and the radiological dose units used in radiodiagnosis and therapy are defined. (JSR)

Vertebrates

Refer also to abstracts 17413, 17423, 17428, 17432, 17493, and 17560.

17499 (CEA-CONF-2958) ALLOGENEIC BONE MARROW GRAFTS IN GENOTYPED SWINE. Vaiman, M.; Arnoux, B.; Daburon, F.; Haag, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). 1974. 7p. (CONF-740832-2). Dep. NTIS (US Sales Only) $4.00.

From 5th international congress of transplantation society meeting; Jerusalem, Israel (22 Aug 1974).

Allografts were made between two breeds of swine. Recipients were given whole-body gamma radiation. Irradiated, ungrafted swine survived for 8 days. All of the incompatibly allografted swine died of hematological symptoms within time limits equal to those of controls. Several animals showed evidence of a host-vs-graft rejection. Seven compatibly grafted swine survived the hematological syndrome. (HLW)

17500 (CONF-750443-3) DOSE-RESPONSE CURVES AND THEIR MODIFICATION BY SPECIFIC MECHANISMS. Yuhas, J. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 23p. Dep. NTIS $4.25.

From conference on the biology of radiation carcinogenesis; Gatlinburg, Tennessee, USA (7 Apr 1975).

Three types of mechanisms are discussed that can contribute to the yield of radiation induced cancer. The relative contribution of each mechanism depends heavily on the tumor type in question. It is suggested that the most fruitful approach to the study of the biology of radiation carcinogenesis is a continued consideration of the mechanisms involved relative to the dose response curves observed. (ERB)

17501 (NP-20386) IRRADIATED GUINEA-PIG GASTRIC MUCOSA. Morphological and Functional Aspects Connected with the Gastritis-Cancer Problem. Capoferro, R. (Rikshospitalet, Oslo (Norway)). 1974. 51p.

Thesis.

A standardized procedure is described for producing irradiation gastritis in the guinea-pig. This yields sufficiently constant results as regards several morphological and functional changes. These changes have several features in common with human chronic atrophic gastritis. The gastric alterations after x-irradiation are reversible, whereas the changes present in human chronic atrophic gastritis appear to be progressive. Intestinal metaplasia was demonstrated, but it seems to be infrequent in irradiation gastritis, whereas it is common in human chronic atrophic gastritis. Hypertonic saline removes gastric mucus and enhances the uptake of DMBA by the gastric mucosa. The theory that mucus may protect the gastric mucosa against carcinogens ingested with the food is supported by the results of the present experiments. Irradiation gastritis seems to enhance the uptake of DMBA, 3 and 5 weeks after irradiation, i.e., at a time when the alterations appear to be most similar to those of human chronic atrophic gastritis. The mechanism of this may be disruption of the mucous barrier and/or increased synthesis of nucleic acids. Separate abstracts are included for 3 attached reprints. Four additional reprints were previously abstracted for NSA as 28: 6026 and 6027, 29: 8022 and 31: 3787. (auth)

For abstracts of individual papers see: 17502–17504.

17502 (NP-20386, pp 527-532) ABSORPTION AND LOCAL UPTAKE OF TRITIATED 7,12-DIMETHYLBENZ(a)ANTHRACENE IN EXPERIMENTAL ATROPHIC GASTRITIS. Capoferro, R. 1974.

In irradiated guinea-pig gastric mucosa. Morphological and functional aspects connected with the gastritis-cancer problem.

The absorption and gastric uptake of tritiated 7,12-dimethylbenz(a)anthracene was studied by liquid scintillation counting in guinea-pigs with irradiation gastritis. Three and five weeks after irradiation, a significantly higher radioactivity was observed in liver and muscle samples from pylorus-ligated, x-irradiated animals, as compared with the controls. Animals which had been irradiated 8 weeks previously did not show any significant difference from the controls. On the other hand, the radioactivity of the gastric wall was increased in both ligated and non-ligated animals irradiated 3 or 5 weeks previously. This may be related to altered secretion of mucus, or to an increased cellular proliferation, which occurs after x-ray injury to the mucosa. (auth)

17503 (NP-20386, pp 533-538) SCANNING ELECTRON MICROSCOPIC STUDY OF NORMAL AND X-IRRADIATED GUINEA-PIG GASTRIC MUCOSA. Capoferro, R. 1974.

In irradiated guinea-pig gastric mucosa. Morphological and functional aspects connected with the gastritis-cancer problem.

The normal gastric mucosa of the guinea-pig revealed a surface structure resembling that of other laboratory animals and man. Three and five weeks after irradiation to the stomach, the mucosal surface was markedly irregular with the formation of small sessile polyps. This seems to indicate abnormal cellular growth with increased desquamation and turnover. The anomalous patterns of the surface structure may be correlated with similar conditions in human chronic gastritis. (auth)

17504 (NP-20386, pp 711-712) INTESTINAL METAPLASIA IN EXPERIMENTAL ATROPHIC GASTRITIS. Sucrase Activity in the Gastric Mucosa of Guinea-Pigs After Stomach Irradiation. Capoferro, R. 1974.

In irradiated guinea-pig gastric mucosa. Morphological and functional aspects connected with the gastritis-cancer problem.

Sucrase activity in the guinea-pig gastric mucosa was demonstrated by means of a macroscopic test 3 and 5 weeks after x-irradiation. The test was negative in non-irradiated animals. Abnormal sucrase activity was attributed to ordinary intestinal metaplasia in one animal, while sections taken from positive sites in the other animals revealed only immature epithelium. (auth)

17505 RECOLONIZATION OF THE BONE MARROW AND THE SPLEEN IN RATS DURING AUTOTRANSPLANTATION OF PROTECTED BONE MARROW IN IRRADIATED RATS AFTER USE OF CYCLOPHOSPHAMIDE. Ninkov, V.; Piletic, O.; Stojanovic, N. (Faculty of Medicine, Belgrade). Med. Istraz.; No. 6-7, 21-24(1972). (In Slovene).

Cyclophosphamide was administered to rats in doses of 200 and 325 mg/kg. The suspension of the bone marrow cells was taken before the administration of cyclophosphamide and was reinjected in the animal 24 hours later. Intensive hematopoietic stimulation was found in the spleen and the bone marrow on the 5th and 7th day after autotransplantation. However, the final effect was smaller after treatment with cyclophosphamide than the effect of transplantation after irradiation. (Bull. Sci., Sect. A)

17506 EFFECTS OF X RADIATION ON THE DEVELOPMENT OF THE CHOLINERGIC SYSTEM OF THE RAT BRAIN. I. Study of Alterations in Choline Acetyltransferase and Acetylcholinesterase Activity and Acetylcholinesterase Synthesis. Valcana, T.; Timiras, P. S. (Univ. of California, Berkeley). Environ. Physiol. Biochem.; 4: 47-57(1974).

X irradiation increases the activity of AChE and ChAc in the brain of developing rat CNS. This increase was observed at dose levels of 450 R or higher, was evident as early as 18 to 48 hours post-radiation, and was a long-lasting effect persisting until adulthood. Not all CNS regions were affected similarly, and the response decreases as the age of the animal at the time of exposure increases. The response seems to be a direct effect of x radiation on the developing central nervous system; and, although it may be modified, it is not mediated through somatic effects of total body exposure inasmuch as qualitatively similar effects are observed through whole-body x radiation and exposures limited to the head region only. (auth)

17507 CHANGES IN THE PROPORTION AND COMPOSITION OF STRUCTURAL PROTEINS DURING THE DEVELOPMENT OF X-RAY CATARACT IN RABBIT LENS. Liem-The, K. N. (Katholieke Univ., Nijmegen, Netherlands). pp 67-82 of Structural Proteins of the Rabbit Eye Lens After X-Irradiation. Liem-The, K. N. (ed.). Nijmegen; Katholieke Univ. (17 Apr 1975).

One eye lens of rabbits was x-irradiated in order to induce a cataract. One, two and three months after exposure, the irradiated lenses and their controls were studied. Between two and three months after exposure, the total protein content diminished, whereas water-insoluble protein increased. It was found that this loss of protein is reflected by the disappearance of β and γ crystallin; a rough estimation revealed a loss of 55% and 65% respectively. In regard to the amount of the urea-insoluble fraction, no essential change was observed, whereas that of the urea-soluble fraction was found to have increased dramatically. The water-soluble fraction was fractionated into five to seven fractions by column chromatography. High-molecular weight crystallin content increased progressively with the maturing of the cataract. This held true especially for HM crystallin in the cortex. Moreover, a decrease was observed in the β crystallin proportion in the late stage of cataract formation. Age-related postsynthetic processes appeared to have taken place in the α crystallin from the control lenses which was reflected in alterations of its subunit composition. X-irradiation of the lens resulted in an early aging of the cortical α crystallin, as reflected by the composition of its subunits, whereas nuclear α crystallin apparently was not affected. (NL)

17508 X-RAY INDUCED CATARACT IN RABBIT LENS. Liem-The, K. N. (Katholieke Univ., Nijmegen, Netherlands); Hoenders, H. J.; Stols, A. L. H.; Jap, P. H. K. pp 51-66 of Structural Proteins of the Rabbit Eye Lens After X-Irradiation. Liem-The, K. N. (ed.). Nijmegen; Katholieke Univ. (17 Apr 1975).

Experimental cataracts were formed by x-irradiation in one eye of two-month-old rabbits with 1800 rad. In the cataractous lens, high-molecular weight (HM) crystallin is present in great amounts in the lens cortex, whereas in the unirradiated lens, this is true only for the nucleus. In the cataractous cortex and nucleus, α and β crystallin polypeptide chains are found; in the normal lens cortex, relatively simple polypeptide chain components exist. Electron microscopic studies of HM crystallin from the cataractous lens cortex and nucleus revealed a wide size distribution of irregularly shaped giant aggregates which were also found in the normal nucleus. Relatively small aggregates were seen in the HM crystallin of the normal cortex. The cataractous lens showed pathological changes, as demonstrated by a distinct granular content of the fibers. Indications for an interpretation of x-ray-induced cataracts in terms of an accelerated aging process are discussed. (NL)

17509 PROLIFERATIVE PATTERNS IN THE MOUSE JEJUNAL EPITHELIUM AFTER FRACTIONATED ABDOMINAL X-IRRADIATION. Lesher, S.; Cooper, J.; Hagemann, R.; Lesher, J. (Allegheny General Hospital, Pittsburgh). Curr. Top. Radiat. Res.; 10: No. 3, 229-261(Jun 1975).

Cell proliferation was studied in the intestinal epithelium of mice exposed to fractionated abdominal x irradiation. Exposures were separated by 12, 24, 48, or 72 hours. Labelled nuclei and mitotic figures per crypt using the crypt squash technique were determined at closely-spaced time intervals (1 to 96 hr) after 1,2,3,5,7 and 9 exposures. Cell cycle times including estimates of G_1,S,G_2 and M were determined at 12 and 24 hours. These data show that the intestinal epithelium has a remarkable potential to repair damage and recover following severe injury if sufficient

time is allowed for the acceleration in proliferative activity. The damage-repair-recovery pattern, i.e., increase in size of proliferative population and acceleration of the generation cycle, is similar for single and fractionated exposures. The number of 300 R exposures which can be tolerated by a highly organized in vivo cell population is dependent upon time interval between fractions; e.g., when interval between fractions is 12 hr eight 300 R exposures kill all animals, but when the interval is increased to 72 hr, some animals survive 20 doses, although time of death is highly variable. The compensatory recovery potential is maintained over a large number of exposures. (NL)

17510 DIFFERENTIAL RADIOSENSITIVITY OF REPRODUCTIVITY AND DIFFERENTIATIVE TRAIT IN CHICK CARTILAGE CELLS CULTURED IN VITRO. Utsumi, H.; Sugahara, T. (Kyoto Univ., Japan). Int. J. Radiat. Biol.; 27: No. 4, 399-401(Apr 1975).

Quantitative comparisons have been made of radiosensitivity for reproductivity and the differentiative trait in chick embryo cartilage cells. Cultures of single chondrogenic cell suspensions from the chick embryonic sternum at various ages were x-irradiated 24 hours after inoculation. After 15 to 18 days of incubation, the cells yielded two types of visible colonies, a cartilage-making colony (CMC) and a fibroblast-like cell colony (non-CMC). Reproductivity was evaluated by total count (CMC plus non-CMC) and the differentiative trait by the percentage of CMC in the total count. The percentage CMC in control cultures varied from 69 to 98, the proportion seeming to depend on embryonic age. The survival curves demonstrated a higher radiosensitivity for the differentiative trait than for reproductivity, and in addition the higher the differentiating stimuli to the cells the lower was the radiosensitivity. The implications for the estimation of teratogenic and carcinogenic effects of low dose irradiation in utero, and for the existing model of cell-renewal systems (which assumes only the radiosensitivity of reproductivity of stem cells) are discussed. (UK)

17511 PROTEIN DIFFERENCES ASSOCIATED WITH THE ABSENCE OF GRANULE CELLS IN THE CEREBELLA FROM THE MUTANT WEAVER MOUSE AND FROM X-IRRADIATED RAT. Mallet, J.; Huchet, M.; Shelanski, M.; Changeux, J. P. (Institut Pasteur, Paris). FEBS (Fed. Eur. Biochem. Soc.) Lett.; 46: No. 1, 243-246(15 Sep 1974).

Experiments done with agranular cerebella from both the mutant weaver(wv) mouse and x-irradiated rats are described. The electrophoretic patterns of the proteins solubilised from subcellular fractions of these cerebella are compared with those obtained with normal mouse and rat. Striking differences are noticed and, by comparison with the patterns obtained with a preparation of purified rat granule cells, assigned to the lack of granule cells. (auth)

17512 ENZYMATIC REPAIR OF X-RAY-DAMAGED DNA. I. Labeling of the Precursor of a Malonaldehyde-Like Material in X-Irradiated DNA and the Enzymatic Excision of Labeled Lesions. Payes, B. (Israel Inst. for Biological Research, Nes Ziona). Biochim. Biophys. Acta; 366: No. 3, 251-260(Oct 1974).

As a result of x irradiation of DNA, the precursor of a malonaldehyde-like material is formed, which remains covalently bound to DNA. This presursor derives from the damaged deoxyribose moiety of DNA, as indicated by lack of its appearance when free bases or ribonucleotides are irradiated. The precursor can be labeled with tritium by reduction with NaB^3H_4. The ^3H-labeled lesions are excised from the DNA as parts of small oligonucleotides by an enzyme which was partially purified from rat liver extract. The enzyme preparation has high affinity for x-ray damaged DNA. Its activity has a pH optimum between 8 and 9, requires Mg^{2+} for activity and is inhibited by Ca^{2+}. (NL)

17513 REPAIR MECHANISMS IN MAMMALIAN CELLS. Loham, P. H. M. (Rijksverdedigingsorganisatie TNO, Rijswijk, Netherlands); Bootsma, D. Mutat. Res.; 23: No. 1, 147-150(Apr 1974).

From review of discussions held at an international workshop; Noordwijkerhout, Netherlands (6 May 1973).

Three general mechanisms for DNA repair have been recognized: (1) Excision repair: This repair mechanism is studied by following the removal of pyrimidine dimers produced in DNA by ultraviolet light. At the enzymological level endonuclease, polymerase and ligase steps are involved. (2) Photoreactivation: This repair mechanism deals specifically with UV-induced pyrimidine dimers in DNA. Near UV light and a specific photoreactivating enzyme work together to monomerize the induced dimers. (3) Post-replication repair: This repair mechanism is coupled to the normal DNA replicating machinery of the cells. In principle this process will lead to normal daughter DNA molecules in the presence of the damage parental DNA strand. The enzymatic details of the process are unknown. Part of this mechanism may include physical exchanges between old and newly synthesized DNA strands (recombination). De novo DNA synthesis of the daughter strand opposite the lesion based on an unknown coding principle is also a possibility for an efficient by-passing of damages in the DNA template. (ERB)

17514 EFFECT OF WHOLE-BODY IRRADIATION ON TRANSCRIPTION IN THE RAT THYMUS. Patil, M. S.; Pradhan, D. S.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). Int. J. Radiat. Biol.; 27: No. 4, 363-370(Apr 1975).

Studies were carried out to elucidate the mechanism underlying the impairment in RNA synthesis in the rat thymus after whole-body exposure to x rays (1000 rad). The ability of thymus nuclei to catalyse RNA polymerization in vitro was adversely affected in irradiated rats. Further experiments showed that whole-body irradiation caused a considerable decrease in both the activity of RNA polymerase and the template efficiency of chromatin but not in that of DNA isolated from chromatin. These radioinduced changes in transcription seemed to arise partly from the direct effect of radiation on the thymus itself and partly from the abscopal mechanism(s). (auth)

17515 LYMPHOCYTE DEPLETION IN PERIPHERAL BLOOD OF ACUTELY GAMMA-IRRADIATED RATS. Goldin, E. M.; Neff, R. D. (Texas Agricultural and Mechanical Univ., College Station). Int. J. Radiat. Biol.; 27: No. 4, 337-342(Apr 1975).

Groups of albino rats were exposed to 200, 800, 2000 and 5000 R of ^{60}Co gamma radiation. Peripheral blood samples were taken from the tail at 1, 2, 4, 8 and 24 hours after irradiation. Calculation of the lymphocyte count per unit blood volume was made for each sample. Control rats were also mock-irradiated and sampled in the same manner. The time response of the lymphocyte count indicated that within the first hour, there was a drastic prompt drop. From one to eight hours after irradiation, the counts declined continuously, and from eight to twenty-four hours less rapidly. The depletion rates for the one to eight hour period were calculated and found to be statistically different for all groups, except between 2000 and 5000 R. (auth)

17516 DIFFERENCES IN THE INTENSITY OF ^{59}Fe INCORPORATION INTO VARIOUS REGIONS OF BONE MARROW OF C57BL/10 MICE AFTER ACUTE RADIATION EXPOSURE. Hola, J.; Vacha, J.; Znojil, V. (Inst. of Biophysics, Brno). Acta Haematol.; 52: No. 3, 151-160(1974).

^{59}Fe incorporation in the marrow of various bones of mice under normal conditions and after acute sublethal whole-body irradiation with x and γ rays is reported. The decrease of incorporation varies for the different regions of the skeleton in the first few days after irradiation. The total incorporation in different skeletal parts exhibits statistically significant changes, when compared with the pre-irradiation stage. A smaller decrease may be observed in the short spongiose bones, the greatest decrease was found in the femur, humerus, tibia/fibula, and pelvis. From the practical point of view, it is important that according to post-irradiation ^{59}Fe incorporation, the femur and tibia, currently used in experiments, are the most reactive bones. This should be taken into account when extrapolating data obtained from these bones to the whole bone marrow of a mouse. (auth)

17517 NARCOTIC ACTION OF HEXOBARBITAL WHEN GIVEN TOGETHER WITH RADIOPROTECTORS OF THE AMINOTHIOL SERIES TO IRRADIATED ANIMALS. Loskutova, Z. F.; Saksonov, P. P. Bull. Exp. Biol. Med. (USSR) (Engl. Transl.); 75: No. 4, 413-414(Apr 1973).

Translated from Byull. Eksp. Biol. Med.; 75: No. 4, 59-60 (Apr 1973).

In experiments on mice, hexobarbital, alone and together with β-mercaptopropylamine, cystamine hydrochloride, and cystamine hydrobromide, was injected 1.5 to 2 h after irradiation of the animals with γ rays (dose 900 R). All three radioprotectors were shown to potentiate the narcotic action of hexobarbital (by 2.8 to 7 times in unirradiated and 6.8 to 17.7 times in irradiated mice compared with the corresponding control). The longest narcotic effect was observed as a result of the combined administration of hexobarbital and cystamine hydrobromide. (auth)

17518 EFFECT OF NEPHRECTOMY ON THE INCIDENCE OF BREAST CARCINOMA IN IRRADIATED PARABIOSED RATS. Brown, C. E.; Chute, R. N.; Porter, M. W.; Warren, S. (New England Deaconess Hospital, Boston). Contract AT(11-1)-3017. Cancer Res.; 35: No. 1, 37-44(Jan 1975).

The incidence of carcinoma of the breast in parabiosed female NEDH rats is 2.5 percent. When one member of such a pair is irradiated, the incidence rises to 11 percent in the irradiated partner and 10 percent in the nonirradiated partner. If in such a pair of rats one kidney is removed from each partner, the incidence of breast carcinoma rises fivefold in the nonirradiated partner. The factors involved in such an increase probably have

to do with alteration in retention, interchange, and feedback of the pituitary and ovarian hormones. (auth)

17519 RADIOBIOLOGICAL STUDIES IN THE AREA OF FISHERY BIOLOGY. Buehringer, H. (Bundesforschungsanstalt fuer Fischerei, Hamburg). pp 95-108 of Kontamination und Dekontamination von Lebensmittein. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

Carp were exposed to x radiation at doses from 2000 to 6000 R in the adult stage in order to determine the LD_{50} and its temperature dependence. The results showed that the LD_{50} for adult carp kept in a reservoir at low temperature was under 2000 R. If the temperature is maintained at a low level for 30 days and then decreased, the surviving irradiated fish soon die. If the irradiated fish are kept in a heated reservoir, the survival time is much shorter. Trout and pike eggs were irradiated at various developmental stages with doses from 250 to 2500 R. The results obtained for trout were in sharp variation with previously reported American studies, as no mortality was detected in the eggs. However, the larvae were damaged to various degrees. The damage to both trout and pike larvae is tabulated. (JSR)

17520 EFFECTS OF X RADIATION ON THE SUBCELLULAR DISTRIBUTION OF CHOLINERGIC ENZYMES IN THE DEVELOPING RAT CEREBELLUM. Valcana, T.; Liao, C.; Timiras, P. S. (Univ. of California, Berkeley). Brain Res.; 73: 105-120(1974).

The developmental pattern of ChAc and AChE activity was studied in cerebellar homogenates and subcellular fractions of control and neonatally x irradiated rats. The activity of AChE in cerebellar homogenate increased with age, while that of ChAc decreased; yet the developmental pattern of total enzymatic activity in the cerebellar structure as a whole showed a progressive increase with age, common to both enzymes. The divergence in the developmental pattern of the two enzymes with respect to activity in the homogenate was also observed in all fractions except in the nuclear fraction, which contains the mossy fiber endings, where a progressive increase was observed in both enzymes. (auth)

17521 EFFECT OF PITUITARY IRRADIATION ON THE RESPONSE OF RAT THYROID TO GOITROGENIC STIMULATION. Malone, J. F. (Coll. of Tech., Dublin); Greig, W. R. Br. J. Radiol.; 48: No. 569, 410-411(May 1975).

The thyroid and pituitary glands were selectively x-irradiated in adult male rats, to establish whether the dose-response function, obtained for cell survival in the rat thyroid, should be partly attributed to a secondary effect from pituitary irradiation. After irradiation, control and irradiated rats were subjected to a goitrogenic regime, consisting of a low iodine diet and 0.1 per cent amino-triazole in drinking water for a period of one month. The rats were then sacrificed and their thyroids dissected out and weighed. A dose of 1,400 rads to the thyroid alone reduced the percentage weight increase to 21 per cent; 2,500 rads to the pituitary alone gave a reduction to 92.6 per cent, which was not statistically significant. In spite of the lead shielding used in the dissected neck during irradiation, there would have been a dose of 100 to 200 rads to the thyroid in the penumbra of the x-ray beam during pituitary irradiation, providing a possible explanation for this small effect. Accidental irradiation of the pituitary during thyroid survival studies should not therefore significantly affect the goitrogenic response. (Uk)

17522 EFFECTS OF X RADIATION ON THE DEVELOPMENT OF THE CHOLINERGIC SYSTEM OF THE RAT BRAIN. II. Investigation of Alterations in Acetylcholine Content. Valcana, T.; Liao, C.; Timiras, P. S. (Univ. of California, Berkeley). Environ. Physiol. Biochem.; 4: 58-63(1974).

Changes are reported in ACh content in the cerebral hemispheres and cerebellum of the rat consequent to exposure to x radiation. Neonatal exposure at 500 R whole-body x radiation increased the ACh content in both brain regions examined, and this increase was accompanied by an increase in the activity of both the synthesizing and catabolizing enzymes of ACh. Exposure of adult animals to x radiation (1000 R), however, affected minimally the ACh content of the cerebral hemispheres and did not induce any changes in the activity of its associated enzymes. It was concluded that the ACh increase consequent to neonatal x irradiation represents a relative increase in the cholinergic elements of these regions, arising from a decrease in their overall growth process and a relative radioresistance of their cholinergic neurons and/or cholinergic innervation. (auth)

17523 EFFECTS OF 400 R WHOLE-BODY X IRRADIATION ON 5-HYDROXYTRYPTAMINE CONTENT OF THE RAT GASTROINTESTINAL TRACT. Penttilae, A.; Kormano, M.; Ahonen, A. (Helsinki Univ. (Finland). Dept. of Diagnostic Radiology). Strahlentherapie; 149: No. 4, 426-437(Apr 1975).

10 figs.; 5 tabs.; 27 refs.

The effects of a single 400 R whole-body dose of irradiation on the regional 5HT content of the gastrointestinal (G.I.) tract were studied from four hours to 40 days after irradiation. The total 5HT content of various G. I. tissues was determined and 5HT was also determined per unit of body weight, wet weight of tissue, and tissue protein. Irradiation caused an immediate decrease of the amine content of various G. I. regions in adult rats. This was followed by recovery, the degree of which varied in different regions. Some minor morphological changes were seen in enterochromaffin cells one and two days after irradiation but not later. The effects of irradiation on the G. I. tissues were stronger in young rats, in whom no complete recovery of 5HT occurred within 45 days. The present results support the view that irradiation exerts a direct damaging effect on the gastrointestinal 5HT storage, which is associated with liberation of 5HT from amine-containing cells. The duration of the effect varies with age and intestinal segment concerned. (auth)

17524 EFFECTS OF CONTINUOUS GAMMA-IRRADIATION DURING WHOLE REPRODUCTIVE PERIOD ON MOUSE OVARY. Muramatsu, S. (National Inst. of Radiological Sciences, Chiba (Japan)). J. Radiat. Res.; 15: No. 3, 121-126(Sep 1974).

Long-term effects of continuous gamma-irradiation with a dose rate of 6R/day were studied of mouse ovaries irradiated during the whole reproductive period, namely from conception until adult age. In the non-irradiated control group age-related changes were observed in their ovaries from 35 to 400 days of age. In the irradiated group, severe histopathological damages were detected in the ovaries. At 35 to 65 days of age, only a few abnormal oocytes were counted in their ovaries. All the females had permanent sterility (the accumulated dose of 330R), and ovarian tumours appeared at early ages (120 days old) as compared to controls (400 days old). The irradiation experiments for a limited period of mice's life-span showed that the irradiation during the suckling period (from birth to weaning) induced a permanent sterility, while the irradiation during the foetal period or the weaning-juvenile period resulted in a partial deletion of oocytes and a partial decrease of ovary weight. (auth)

17525 ROLE OF LIPID PEROXIDE IN THE INDUCTION OF RETINOPATHY BY X IRRADIATION. Hiramitsu, T.; Majima, Y. (Fujitagakuen Univ., Toyoake, Aichi (Japan). School of Medicine); Hasegawa, Y.; Hirata, K. Nippon Ganka Gakkai Zasshi; 78: No. 9, 819-825(Sep 1974). (In Japanese).

The role of lipid peroxide in the x-irradiated retinopathy was examined. The relationship between the lipid peroxide formation and the ERG amplitude of the rabbit retina after x irradiation in vivo were examined. Only the head of the rabbits was exposed to dose of x irradiation within the range 1 to 6 kilorads. After x irradiation, the amplitude of ERG was determined and then lipid peroxide determination in the retina was carried out using the thiobarbituric acid method. Retinas after irradiation at 2 to 4 kilorads formed a significantly increased lipid peroxide and the retinas after a dose of 3 kilorads showed the greatest lipid peroxide value. The amplitudes of a- and b-components of ERG showed no significant changes in the eyes irradiated to the dose of 3 kilorads or less and they were inversely related to the dose in the range from 3 to 6 kilorads. The remarkably elevated value of lipid peroxide prior to the reduction of the ERG amplitude was observed in the experiments. The eye enucleated at 2 days after x irradiation (6000R) showed mainly the remarked pyknosis of visual cell nuclei and the advanced degeneration of visual cell layers associated with inflammatory changes of the uveal hemorrhage and edema. The lipid peroxide may play an important role in the occurrence of x irradiation retinopathy. (auth)

17526 INCIDENCES OF NON-PROTEIN THIOL COMPOUNDS IN THE ORGANS OF MICE FOLLOWING X IRRADIATION. Kubokura, T. (Nihon Univ., Tokyo. School of Medicine). Nichidai Igaku Zasshi; 33: No. 11-12, 917-933(Dec 1974). (In Japanese).

After exposure to a single whole-body x irradiation with varying doses (50, 200, 600, 1,000, and 2,000 R), the incidences of total SH (T.T), reduced glutathione (GSH), oxidized glutathione (GSSG), and the rest SH(R-SH) in the liver, kidney, spleen, and muscle of mice during two weeks were determined by the enzymatic spectrophotometric method. Further observation was made about the effect of the medication of glutathione and alcohol prior to the irradiation, which have been regarded as radiation-protective agents. The amounts of these thiol compounds in the liver, kidney, and spleen showed some different incidences depending on the irradiation doses. In the groups exposed to an irradiation dose of 50 to 1,000 R, the T.T and GSH contents were increased roughly in proportion to the increase in x-ray dose. It was also found in the groups with a radiation dose of 600 R or less that such an increase

in thiol compounds tended to return to the normal level with time. In contrast, in the group exposed to 2,000 R, there was a decrease in thiol compounds after the irradiation. The incidence of the R-SH did not always run parallel with those of T.T and GSH and sometimes showed an inverse pattern. The GSSG content in the liver was reduced after the irradiation. By the injection of glutathione or ethylalcohol, radiation-protective substances, prior to the irradiation, the changes in the level of non-protein thiol compounds caused by x-irradiation were reduced in the liver and kidney, but not so remarkably in the muscle. (auth)

17527 SELECTIVE BLOCKING OF THE NODAL SODIUM CHANNELS BY ULTRAVIOLET RADIATION. P. 2. The Interaction of Ca^{++}, H^+, and Membrane Potential. Fox, J. M. (Universitaet des Saarlandes, Homburg/Saar (F. R. Germany). Inst. fuer Physiologie 1). 351: No. 4, 303-314(1974).

5 figs.; 1 tab.; 25 refs.

Isolated nodes of Ranvier were exposed to ultraviolet radiation of 280 nm wavelength under the conditions of different external concentrations of calcium and hydrogen ions. Both Ca^{2+} and H^+ sensitize the ultraviolet photoreaction at the nodal sodium system. The increment of sensitivity per tenfold increase of $[Ca^{2+}]_e$ is 40% of the control value (determined at 1.8 mM$[Ca^{++}]_e$). The sensitizing effect of H^+ is approximately half as large as that of Ca^{2+}. The sensitization caused by the action of hydrogen ions apparently is restricted to those channels not blocked by protonation, while the population channels blocked by protonation appears to be partly protected. Their ultraviolet sensitivity is decreased by roughly 7% per tenfold increase of $[H^+]_e$. The sensitizing effect of Ca^{2+} and H^+ is not due to a screening of negative surface charges at the nodal outside. Ultraviolet radiation apparently affects a functional structure of the sodium channel that is related to the outside components of the nodal membrane. (auth)

17528 TUMOR REJECTION IN EXPERIMENTAL ANIMALS TREATED WITH RADIOPROTECTIVE THIOLS. Apffel, C. A.; Walker, J. E.; Issarescu, S. (Pondville Hospital, Walpole, MA). Cancer Res.; 35: No. 2, 429-437(Feb 1975).

In experimental animals, a systemic treatment with thiols of the mercaptoalkylamine type has affected all of five solid tumors so far investigated. There was either inhibition of growth or "oncodieresis," i.e., a necrosis and sloughing of tumors conducive to full recovery and repair. Mercaptoalkylamines and derivatives of the type used in our experiments are known to bind to cellular sites by a two-point attachment involving both thiol and amino groups. One of these compounds, cysteamine, was active in its native, unsubstituted form, but did not bring about oncodieresis when either the amino or thiol group, or both, were alkylated. Mercaptopropylamine, the 3-carbon homolog of cysteamine, was less active. Cystamine, a disulfide dimer of cysteamine that has no free reactive sulfhydryl, did not induce any reaction. Thioglycerol, lacking a terminal amino group, had only negligible activity. Rejection was much more striking when treatment was started on the day of inoculation than when started 7 days later. Male mice rejected better than females. Results were inferior when two of the agents were given simultaneously or together with other radioprotectants, such as L-cysteine, glutathione, dimethyl sulfoxide, or reserpine. Tumor rejection was enhanced when the phosphorylated thiols, S-2-(3-aminopropylamino)ethylphosphorothioic acid or S-(2-ethylguanidine)phosphorothioic acid, were given simultaneously with the radioprotective serotonin, but there was no synergy of serotonin with the nonphosphorylated compounds S-2-aminoethylisothiouronium bromide or cysteamine. Serotonin alone did not affect the tumors. (auth)

17529 CULTURE OF NORMAL AND LEUKEMIC CELLS IN DIFFUSION CHAMBERS. Cronkite, E. P.; Carsten, A. L.; Chikkappa, G.; Laissue, J. A.; Oehl, S. (Brookhaven National Lab., Upton, NY). Adv. Biosci.; 14: 273-286(1973).

Normal murine, caprine, and human bone marrow and peripheral blood cells can be grown in diffusion chambers (DC). The irradiated host provides a stimulus to erythrocytic and granulocytic growth over what is seen in the DC implanted in the nonirradiated host. The stimulus is most likely humoral and affects erythropoiesis, granulopoiesis, and megakaryocytopoiesis. It is suggested but not proven that the stimulus for erythropoiesis is an increased level of plasma erythropoietin. It is tempting to suggest that CSF and thrombopoietin are responsible for the stimulation of the other cell lines. Growth of normal human cells in irradiated mice shows a marked reduction of the transit time from the myelocyte to the segmented neutrophils. Growth does not follow steady conditions in terms of rates and transit times. Since all cells produced are retained in the DC after the time they would normally be extruded into the blood, a nonsteady state system exists. Senescent death of nonproliferating cells occurs. Human leukemic and multiple myeloma cells grow in DC as do blood cells from patients with myelofibrosis and myeloid metaplasia. Data are insufficient to characterize aberrations in growth. Pilot studies show that human eosinophils will grow, proliferate, and mature. (auth)

17530 EFFECTS OF RADIATION ON THE TESTIS. Oakberg, E. F. (Oak Ridge National Lab., TN). Endocrinology; 5: 233-243 (1974).

The type A/sub s/ spermatogonium of the mouse and rat and its counterpart in other species are the most important cells of the mammalian testis in relation to fertility and the genetic effects of radiation in mammals. All long-term effects of dose rate, dose fractionation, total dose, and quality of radiation on these parameters are related to the response of the A/sub s/ spermatogonia. (auth)

17531 SYNTHESIS AND TUMOR-UPTAKE STUDY OF PHOSPHATE ESTERS OF POLYHEDRAL HYDROXYBORANES. Bechtold, R. A. (Tufts Univ., Medford, MA); Kaczmarczyk, A.; Messer, J. R. J. Med. Chem.; 18: No. 4, 371-376(1975).

The phosphorylations of $B_{12}H_{11}OH^{2-}$, $B_{12}H_{10}(OH)_2^{2-}$, $B_{20}H_{17}OH^{4-}$ with $POCl_3$ and $(C_6H_5O)_2POCl$ were investigated and the following derivatives were isolated: $B_{12}H_{11}OPO_3H^{3-}$, $B_{12}H_{11}OPO_3H_2^{2-}$, $B_{12}H_{11}OPO(OC_6H_5)_2^{2-}$, $B_{12}H_{11}OPO(OC_6H_5)OH^{2-}$, $B_{12}H_{10}(OP_2O_6H_2)_2^{4-}$, $B_{12}H_{10}(OPO_3H_2)_2^{4-}$, $B_{12}Br_{10}(OPO_3H)_2^{4-}$, $B_{12}H_{10}[OPO(OC_6H_5)_2]_2^{2-}$, $B_{20}H_{18}OP_2O_6H_2^{4-}$, $B_{20}H_{18}OPO_3H_2^{3-}$. The B–O–P bonds proved very resistant to hydrolysis and the phosphates were administered in the form of Na^+ salts at pH 7.2 to rats bearing subcutaneous glioma. The boron concentrations in tumors and the tumor/blood concentration ratios were compared with those of parent hydroxy derivatives. Except when the POH function was blocked by phenyl groups the phosphorylation invariably resulted in a greatly enhanced uptake of the borane into tumors and improved the tumor/blood boron ratio. The phosphate function appears to be one of the most effective handles for the incorporation of boron into brain tumors and the compounds show considerable promise for use in the neutron capture therapy of brain tumors. (auth)

17532 CELL KINETICS OF EHRLICH ASCITES CARCINOMA TRANSPLANTED IN MICE WITH DIFFERENT DEGREES OF TUMOR RESISTANCE. Brandt, K. L. B. Iowa City, IA; Univ. of Iowa (1974). 154p. University Microfilms Order No. 75-13,727.

Thesis (Ph. D.).

Cell proliferation kinetics of Ehrlich ascites carcinoma grown in two strains of mice with different degrees of resistance to this tumor were examined. In the first portion of the study, growth of Ehrlich ascites carcinoma in nonresistant Swiss (Iowa) and slightly resistant CF 1 mice was examined by measuring animal weight gain and host survival time after intraperitoneal injection of tumor cells. Since it appeared that CF1 mice were inherently more resistant than Swiss mice to the Ehrlich carcinoma, the second part of this investigation involved attempts to immunize CF1 mice against the tumor. Subcutaneous injections of Ehrlich cells previously exposed in vitro to 5000 R of 250 kVp x rays were utilized. One immunizing inoculation of lethally irradiated tumor cells afforded protection against an intraperitoneal challenge of 40 thousand Ehrlich cells. By varying the number and timing of immunizing inoculations it was possible to induce different degrees of tumor resistance in these mice. The most effective immunizing procedure utilized multiple inoculations of lethally irradiated tumor cells (LITC), followed by challenges with viable tumor cells (less than 1 million) which were rejected. These mice could then resist challenge inocula of 4 million viable tumor cells. In a few animals the immunizing procedures were ineffective; these animals, when challenged, developed even larger tumors than control mice. Tumor cell proliferation kinetics in these animals as well as in mice that were rejecting the tumor were examined in the third phase of the project. A shortening of the cell cycle was observed in almost all LITC-treated mice, whether tumor growth was eventually inhibited or stimulated. Decreased duration of the DNA-synthesis phase (S) of the tumor cell cycle was also a consistent finding. The role of the immune response in stimulating mitosis as well as in killing foreign cells was discussed. (ERB)

17533 STUDY OF HOMING PATTERNS OF X-IRRADIATED MURINE LYMPHOID CELLS. Crouse, D. A. Iowa City, IA; Univ. of Iowa (1974). 122p. University Microfilms Order No. 75-13,739.

Thesis (Ph. D.).

Effects of in vitro x-ray exposure of murine lymphoid cells on their subsequent in vivo homing patterns were studied. The homing of lymphoid cells to various tissues and organs was followed by using radiolabeled cell preparations or by following the distribution of cells with a specific immunological memory. Cell suspensions were prepared from the spleen, lymph nodes, bone marrow, or thymus of BDF_1 mice and labeled in vitro with ^{51}Cr prior to irradiation (0, 100, 300, and 800 R) and transfer to a syngeneic host.

X irradiation of ^{51}Cr-labeled spleen, lymph node, bone marrow, or thymus cells was found to significantly alter their subsequent in vivo distribution. Lymph node cell suspensions from dinitrophenylbovine gamma globulin (DNP–BGG) immune LBN rats were prepared, irradiated (0 and 200 R) and injected into intermediate (LBN) hosts and controls. After correcting for the fraction of the total cell population transferred from the intermediate host, the peak antigen binding capacity of the final hosts was related to the number of memory cells present. Irradiated memory cells provided a secondary antibody response, which was delayed but not suppressed when compared to unirradiated cells. In intermediate hosts, the homing of lymph node memory cells to the spleen and lymph nodes was significantly reduced by exposure to 200 R of x irradiation. It is generally proposed that the alteration in homing of lymphocytes caused by various agents is a result of effects on cell membrane characteristics. Radiation (100 to 200 R) may have had a similar effect or it may have resulted in the selective elimination of a population of cells. (ERB)

17534 STUDIES OF RADIATION INDUCED MEMBRANE DAMAGE IN LYMPHOCYTES USING FLUORESCENT PROBES. Nikesch, W. Los Angeles, CA; Univ. of California (1974). 143p. University Microfilms Order No. 75-10,108.

Thesis (Ph. D.).

The flucrescent probes perylene (PER), 1-anilino-8-naphthalene sulfonic acid (ANS), and fluorescein diacetate (FDA) were used to investigate membrane changes caused by ionizing radiation. Probe response to various other perturbations (variation of pH, temperature, and salt concentration, and treatment with phytohemagglutinin (PHA) and saponins) was also investigated to better understand membrane-probe interactions. ANS was used to probe the membrane surface, PER to probe the membrane interior, and FDA to investigate membrane integrity. Polarization of fluorescent light from ANS and PER was used to investigate the microviscosity and order of the membrane surface and interior respectively. Irradiated cells (600 R) were shown to have a decreased rate of hydrolysis of FDA probably due to cytoplasmic changes effecting the enzymatic reaction. Also evident was an increase in loss of intracellular fluorescein and a decrease in PER polarization indicating that the cells have a decreased membrane integrity, possibly the result of an increased disorganization of the phospholipid hydrocarbon chains in the membrane interior. Experiments with PHA link the decreased membrane integrity with the eventual interphase death of the cells. In general it is shown that the fluorescent probes ANS, PER, and FDA provide useful ways to investigate order and microviscosity in the cell membrane surface and interior, membrane surface charges, internal membrane polarity changes, and membrane integrity. (ERB)

17535 COMBINED EFFECTS OF IODOACETAMIDE, X RAYS, AND MAGNETIC FIELDS ON A MURINE ASCITES TUMOR. Feola, J. M. Minneapolis, MN; Univ. of Minnesota (1974). 199p. University Microfilms Order No. 75-12,065.

Thesis (Ph. D.).

An ascites tumor (lymphoma, LSA) of the C57BL mouse was used to determine whether or not iodoacetamide (IA) is a potentiator of x rays. It was experimentally shown that a dose of 10^{-3} M of the drug, which was not toxic to the mice, was the best for this purpose. Preliminary experiments were performed by treating the cells in vitro, and assaying for tumorforming ability by reinjection (intraperitoneal, i.p.) into normal mice. The end point was the TD_{50}, that is, the number of cells needed to cause tumors in 50 percent of the mice. By comparing the TD_{50} for control groups with those of treated groups, survival curves were drawn. Treatment with x rays alone gave a survival curve of the multitarget, single-hit type, with a mean lethal dose (D_0) of D_0 equals 120 rads and an extrapolation number, n, of 4.0. These values are typical of mammalian cells irradiated under aerated conditions. When the cells were irradiated in the presence of 10^{-3} M IA, the shoulder of the curve was eliminated, but the slope was not changed. When the irradiation was done after injection of 10^{-3} M IA, the shoulder of the survival curve was again eliminated, but a change in slope was now observed (D_0 equals 243 rads), indicating that IA is a radiosensitizer. Under the criteria used, IA showed a potentiating effect greater than 2.0, indicating that this drug may be useful in therapy. The synergistic effects of a magnetic field (MF) of 100 Oersted, either constant or alternating at 60 Hz, were studied in the in vivo-in vivo system. No synergistic effects of the MF plus x rays, or MF plus IA were observed. When the three agents acted together, it was shown that the survival curve obtained with x rays plus IA was displaced towards the control curve (x rays plus saline), showing that the MF protected the tumor cells from the combined action of the IA and the x rays acting together. These results may be of importance in environmental health as well as in combined therapy. (ERB)

17536 ULTRAVIOLET LIGHT-INDUCED UNSCHEDULED DNA SYNTHESIS IN ISOLATED MYOCARDIAL CELLS FROM DIFFERENT AGED RATS. Lampidis, T. J. Coral Gables, FL; Univ. of Miami (1974). 132p. University Microfilms Order No. 75-12,856.

Thesis (Ph. D.).

Early in the life of the rat, its myocardial cells cease dividing and no longer undergo normal DNA synthesis. Heart cells, therefore, remain for the duration of the animal's life span and are thus exposed to whatever environment that accounts for biological aging in the organism at a cellular level. We reasoned that these cells would serve as a good model for testing out hypothesis that DNA repair might not be as efficient in adult cells as it is in young cells. As a measure of DNA repair capacity, we measured unscheduled DNA synthesis induced by ultraviolet (uv) irradiation. Our study began where singly isolated, pulsating rat myocardial cells were recovered from the hearts of 20 to 30 newborn (2 to 60 hours old) rats by excising, mincing, and treating them with trypsin. Routinely 2×10^6 cells/ml, were obtained and used to assay unscheduled DNA synthesis. Using 1×10^{-1} M hydroxyurea, 95 percent of normal incorporation of radioactive thymidine can be inhibited thus allowing for incorporation due to repair to be studied with the techniques of liquid scintillation counting and autoradiography. Both methods indicate that upon exposing these cells to 450 ergs/mm^2 of 254 nm UV, unscheduled DNA synthesis ensues. Upon developing a technique for isolating beating heart tissue fragments from adult animals we were able to show that these cells do not undergo unscheduled DNA synthesis when exposed to uv light under the same conditions. These results suggest that as a consequence of the cell becoming post mitotic, it may lose its ability to repair at least one kind of damage incurred by its DNA. It is therefore reasonable to visualize how damage or subtle changes in the fidelity of DNA over the entire span of an organism's life could accumulate and eventually have serious effects on the proteins produced by these cells and thus affect their functional ability. (Diss. Abstr. Int., B)

17537 PHYSIOLOGIC RESPONSES TO EXERCISE OF IRRADIATED AND NONIRRADIATED SHETLAND PONIES: A FIVE-YEAR STUDY. Brown, D. G. (Comparative Animal Research Lab., Oak Ridge, TN). Am. J. Vet. Res.; 36: No. 5, 645-652(May 1975).

Physiologic responses of irradiated and nonirradiated Shetland Ponies to controlled exercise were measured over a period of 5 years. The 5-year test began when the ponies were 3 years old and 5 months after they were exposed to 650 R of ^{60}Co gamma radiation. Significant differences in heart rates, respiratory rates, and rectal temperatures were demonstrated between irradiated and nonirradiated ponies when subjected to exercise and high ambient temperatures. In the irradiated group, heart rates were usually slower, especially during recovery immediately after exercise, and respiratory rates and rectal temperatures were higher than these rates were in the nonirradiated group when exercising in ambient temperature of 29.5 C. Exhaustive exercise did not amplify any of the differences which were apparent with moderate exercise. From a general viewpoint, the irradiated ponies performed work as efficiently as did the nonirradiated ponies. Early changes in blood-cell concentrations after irradiation were similar to those which have been observed in other large animal species. Time required for the various types of blood cells to return to base line values ranged between 3 months and 3 years. (auth)

Invertebrates

Refer also to abstracts 17188, 17421, and 17459.

17538 SENSITIVITY OF ORYZAEPHILUS SURINAMENSIS (COLEOPTERA:CUCUJIDAE) TO CESIUM-137. I. Irradiation of Eggs: The Effects on Hatching, Survival, and Fecundity. Chawla, S. S.; Perron, J. M.; Huot, L.; Corrivault, G. W. (Laval Univ., Quebec City). Can. Entomol.; 105: No. 2, 283-288(Feb 1973).

Oryzaephilus surinamensis L. eggs in three age groups were irradiated with a ^{137}Cs γ source. Irradiation dosages of 15,480 rads did not affect the hatching of 48- to 72-hr-old eggs, though 24- to 48-hr-old eggs were more resistant than 0- to 24-hr-old eggs. LD_{50} values measured as survival of 7-day-old larvae, however, showed that 48- to 72-hr-old eggs were more sensitive than 24- to 48-hr-old eggs. Dosages from 1935 to 2580 rads depressed the fecundity of adults emerged from irradiated eggs. (auth)

17539 USE OF FAST NEUTRONS AND GAMMA RADIATION TO STERILIZE THE TSETSE FLY GLOSSINA TACHINOIDES WESTW. Offori, E. D.; Czock, K. H. (International Atomic Energy Agency, Vienna). Int. J. Appl. Radiat. Isot.; 26: No. 5, 257-260(May 1975).

The response of male Glossina tachinoides Westw. to fast neutron and γ radiations was determined by irradiating 0 to

36 hr old males using the Standard Neutron Irradiation Facility at the Austrian Atomic Energy Research Laboratory, and the ^{60}Co Gamma Cell 220$^{(R)}$ source at the IAEA Laboratory, Seibersdorf. Irradiated males were mated when 6 or 7 days old to untreated, 2 to 3 day old virgin females for 24 to 48 hr. After mating, sexes were held separately in groups of 10 in oblong PVC-screen cages. Male survival was recorded for 30 days and pupa production for 45 days. Results showed that the highest neutron dose tested (1.70 krad) produced the same level of sterility (87 to 89%) as 9 krad γ radiation. It was estimated that 2 to 2.5 krad neutron or 10 to 12 krad γ radiation would be required to induce 95% sterility. Evidently, neutrons are about 4 times more effective than γ rays in producing sterility in this species of tsetse fly. Considering the doses tested that produced the same level of sterility, male survival was similar in both neutron- and γ-irradiated groups. (auth)

17540 STUDIES ON THE RADIATION-INDUCED DISSOCIATION AND REASSOCIATION OF POLYSOMES IN TETRAHYMENA PYRIFORMIS. Oleinick, N. L.; Rustad, R. C.; Kuncio, G. S. (Case Western Reserve Univ., Cleveland). Biochim. Biophys. Acta; 366: No. 2, 215-223(Oct 1974).

A new high-yield method for isolation of polysomes from the ciliated protozoan Tetrahymena pyriformis employs the antibiotic cycloheximide, rapid chilling of the cells, and lysis in the non-ionic detergent NP-40. Following dissociation by sublethal doses of γ radiation, two types of recovery occur. Cycloheximide present during the irradiation prevents the radiation-induced dissociation of polysomes. Radiation blocks the recovery of polysomes from puromycin-induced dissociation but only during the period of exposure to the radiation. Radiation blocks nearly all amino acid incorporation during the exposure period while 6% of the polysomes still remain intact. While radiation may interfere with initiation of protein synthesis, this cannot be the sole action of radiation on protein synthesis. A further effect on the systematic elongation and termination of polypeptide chains is proposed. (NL)

Radionuclide Effects (Internal Source)

Refer also to abstract 17185.

Man

Refer also to abstracts 17179, 17461, 17462, and 17482.

17541 (AAEC/E-311) HAEMOLYTIC ACTIVITY OF URANIUM COMPOUNDS: HAEMOLYSIS BY THERMOCHEMICAL DERIVATIVES OF AMMONIUM URANATE. Stuart, W. I.; Tucker, A. D.; Adams, R. B.; Smith, H. E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jan 1975. 19p. Dep. NTIS (US Sales Only) $4.00.

A study was made of the haemolytic action on human erythrocytes by ammonium uranate (AU) and various thermochemical products of AU. These products were obtained by heating AU in hydrogen at 5°C min^{-1} to various temperatures. Haemolysis was interpreted in terms of a diffusion model, which for each product yields a single parameter K_n, the haemolytic activity factor. The magnitude of K_n is a convenient measure of the ability of a powder to damage erythrocytes. The haemolytic activity of certain thermochemical derivatives indicates an exceptionally high potential for damage to erythrocytes. Infrared and thermoanalytical measurements showed that the high activity of these products derived principally from a self-reduction reaction, induced by heating AU to 400-420°C in hydrogen. (auth)

17542 (AAEC/E-350) NEW APPROACH TO THE ESTIMATION OF RADIOPHARMACEUTICAL RADIATION DOSE DISTRIBUTIONS. Hetherington, E. L. R.; Wood, N. R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

For a photon energy of 150 keV, the Monte Carlo technique of photon history simulation was used to obtain estimates of the dose distribution in a human phantom for three activity distributions relevant to diagnostic nuclear medicine. In this preliminary work, the number of photon histories considered was insufficient to produce complete dose contours and the dose distributions are presented in the form of color-coded diagrams. The distributions obtained illustrate an important deficiency in the MIRD Schema for dose estimation. Although the Schema uses the same mathematical technique for calculating photon doses, the results are obtained as average values for the whole body and for complete organs. It is shown that the actual dose distributions, particularly those for the whole body, may differ significantly from the average value calculated using the MIRD Schema and published absorbed fractions. (auth)

17543 (RD/B/N-3328) DOSES TO INTERNAL ORGANS RESULTING FROM THE INHALATION OF LARGE RADIOACTIVE PARTICLES. Bailey, M. R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1975. 55p. Dep. NTIS (US Sales Only) $5.75.

There has been a tendency to assume that 'non-respirable' particles, i.e., those which are too large to penetrate to the deep lung, do not constitute an inhalation hazard, even though such large airborne particles are readily deposited in the upper airways. The deposition of large particles in the respiratory tract, the transfer of activity to other organs and the resulting doses are discussed in the light of current ICRP recommendations, changes in those recommendations likely to be made in the near future, and recent experimental results. While the doses incurred by inhaling large radioactive particles are usually smaller than those which would be delivered by the same amount of activity in the form of smaller particles, they are not generally negligible. In addition, the lower hazard from large particles may be partially offset by the difficulty in measuring a given level of activity when it is dominated by a small number of highly active particles. The terminology of particle sizing is somewhat confusing since the 'size' of a particle depends on the method of measurement used, and a detailed appendix describing the various terms and their interrelationships is therefore included. (UK)

17544 (ZFK-282) EVALUATION OF RADIATION BURDEN RESULTING FROM THE INCORPORATION OF RADIONUCLIDES. Fietz, J. (Zentralinstitut fuer Kernforschung Rossendorf bei Dresden (German Democratic Republic)). Jul 1974. 20p. (In German). Dep. NTIS (US Sales Only) $4.00.

A presentation of methods for recording and interpretation of internal radiation burdens based on existing models is followed by considerations concerning the evaluation of the dose equivalent for an unknown mode of incorporation between two controlling measurements. Hereafter some practical aspects of the interpretation of internal radiation burdens within a routine monitoring program are discussed under consideration of national legal decrees and international recommendations. (auth)

17545 ENDOLYMPHATIC LIPIODOL-P32 THERAPY IN MELANOMA OF THE LIMBS DURING CLINICAL STAGE 1. Kokoschka, E. (Univ., Vienna). Med. Welt; 25: No. 23, 1054-1055(7 Jun 1974). (In German).

The results obtained since 1969 in the treatment of stage I melanoma in which surgical excision was preceded by fast electron irradiation and followed by endolymphatic ^{32}P-lipiodol therapy are reported for 40 patients. Positive scans were obtained for eight patients after therapy. The clinical findings for the other 32 patients are tabulated. The low number of cases and the relatively short observation time make impossible a valid evaluation of this therapeutic process. (JSR)

17546 RESULTS OF LYMPHOGRAPHIC COURSE CONTROLS FOLLOWING ENDOLYMPHATIC RADIONUCLIDE THERAPY. Wolf, G. (Univ., Vienna). Med. Welt; 25: No. 23, 1050-1054 (7 Jun 1974). (In German).

The morphology of lymph nodes following endolymphatic radionuclide therapy of neoplasms with ^{131}I- or ^{32}P- lipiodol was examined from three aspects: the size reduction of the lymph nodes, duration of the contrast medium accumulation, and histology of the lymph nodes. (JSR)

17547 EXPERIENCES WITH ENDOLYMPHATIC RADIONUCLIDE THERAPY IN SYSTEMIC DISEASES AND TESTICULAR TUMORS. zum Winkel, K.; Harbst, H.; Nagel, R.; Albrecht, D.; Keilbach, H. (Freie Univ., Berlin). Med. Welt; 25: No. 23, 1048-1050(7 Jun 1974). (In German).

The results obtained since 1964 in the endolymphatic radionuclide therapy with ^{131}I or ^{32}P in lymphomas and testicular tumors are summarized and evaluated. The indications for this therapy are outlined and the technique is given. (JSR)

17548 TABULAR AND CASE DEMONSTRATIONS OF 100 MALIGNANT MELANOMAS TREATED BY ENDOLYMPHATIC THERAPY. Makosiki, H. B.; Scherer, E. (Univ., Essen). Med. Welt; 25: No. 23, 1042-1044(7 Jun 1974). (In German).

On the basis of the results obtained in the treatment of more than 100 malignant melanomas, the most important indications for post-operative endolymphatic radionuclide therapy with ^{131}I or ^{32}P in the treatment of melanomas of the lower extremities and associated lymph node clearance are tabulated. (tr-auth)

17549 EXAMINATION TECHNIC AND MONITORING OF PATIENTS IN ENDOLYMPHATIC RADIONUCLIDE THERAPY. Peters, P. E. (Univ., Muenster, Ger.). Med. Welt; 25: No. 23, 1031-1035(7 Jun 1074). (In German).

The precautions which must be taken in endolymphatic radionuclide therapy of neoplasms using ^{131}I or ^{32}P which differ from the known techniques of diagnostic lymphography are discussed on the basis of pre-examination of the patient, radiation protection, modification of the examination technique, patient mon-

itoring during injection, and patient care following the therapy. (JSR)

17550 RADIATION: DOSIMETRY STUDIES AFTER ENDOLYMPHATIC RADIONUCLIDE THERAPY. Pfannenstiel, P. (Deutsche Klinik fuer Diagnostik, Wiesbaden, Ger.). Med. Welt; 25: No. 23, 1038-1042(7 Jun 1974). (In German).

^{32}P-lipiodol has many theoretical and practical advantages over the earlier used ^{131}I-lipiodol for endolymphatic radionuclide therapy of neoplasms. However the results reported show that the determination of the radiation dose after therapeutic radionuclide incorporation using anatomical and biological indicators is far removed from a physically exact dosimetry. Nevertheless it appears possible on the basis of the results discussed to determine the absorbed local dose in the first approximation and therefore to evaluate better the individual pattern. The risk of the radiation burden of the lungs, unavoidable in any lymphatic radionuclide therapy, can be better estimated. (tr-auth)

17551 FOLLOW-UP STUDIES ON MALIGNANT MELANOMAS AFTER ENDOLYMPHATIC RADIONUCLIDE THERAPY. Gehring, D.; Baumeister, L. (Univ., Freiburg i. B.). Med. Welt; 25: No. 23, 1045-1047(7 Jun 1974). (In German).

The results of follow-up studies made on 67 patients treated since 1968 with endolymphatic radionuclide therapy using ^{131}I and ^{32}P after excision of the primary melanoma are reported. The therapeutic method is outlined. The most significant result is that development of lymph node metastases was detected in none of the patients who had a normal x-ray lymph node picture at the time of the therapy. Undesirable side effects of this therapy observed in some patients are discussed. (JSR)

17552 DOSIMETRIC ASPECTS OF DIRECT INTRALYMPHATIC ADMINISTRATION OF RADIOACTIVE GOLD IN GYNECOLOGY. Vebersik, V.; Dvorak, O. (Karlova Univ., Prague). Cas. Lek. Cesk.; 113: No. 35, 1059-1063(30 Aug 1974). (In Czech).

The dosimetric aspects and some new observations concerning the direct intralymphatic administration of ^{198}Au during the treatment of 36 patients, for the most part cases of carcinoma of the vulvae are described. Most administrations were made postoperatively and the distribution of radioactive gold in the organism, the dependence on the technique, rate of administration and concentration of radioactive gold colloid are discussed. Conditions are described in which lymphatic vessel obstruction, reflux or refilling are inclined to occur. The therapeutic value of intralymphatic administration of radioactive gold in gynecology is discussed. (auth)

17553 RADIATION HAZARDS. Soman, S. D.; Pillai, K. C. (Bhabha Atomic Research Centre, Bombay). Sci. Today (Bombay).; 9: No. 3, 23; 26-27(Sep 1974).

With the development of nuclear energy for power generation, and use of radioisotopes in medicine, industry and agriculture, concern has been voiced about the environmenta: and personnel hazards due to nuclear radiations. Effects to understand and minimize the radiation hazards have been undertaken and the International Commission on Radiological Protection has evolved safety criteria for radiation workers and the public. The maximum permissible concentrations of certain radioactive pollutants as recommended by ICRP are listed. Safety investigations are also conducted at reactor sites on critical pathways, nuclides, and population before selection. Environmental factors for possible hazards of radioactivity are studied before conducting underground explosions. By conforming to stringent safety standards, it has been shown that it is possible to apply nuclear energy for peaceful purposes and benefit immensely without producing deleterious effects. (INIS)

17554 CHROMOSOME ABERRATIONS IN LYMPHOCYTES FROM PATIENTS WITH LOW BODY BURDENS OF ^{226}Ra. Hoegerman, S. F.; Cummins, H. T.; Greco, L.; Bronec, J. F. (Argonne National Lab., IL). Health Phys.; 28: No. 6, 820-823(Jun 1975).

The use of chromosome aberration analysis for the study of individuals with body burdens of bone-deposited ^{226}Ra below the occupational MPB of 0.1 μCi is reported. Data on the level of chromosome breakage in eight patients and nine controls are presented. It is concluded that cytogenetic abnormalities found in individuals with fractional MPB's of ^{226}Ra cannot be a consequence of their radium burden. (UK)

17555 USE OF UNITHIOL FOR REDUCING RADIATION HAZARD OF RENAL SCINTIGRAPHY WITH CHLORMERODRIN ^{203}Hg. II. Scintigraphic Estimation. Kloczkowski, K.; Oginski, M. (Medical Academy, Lodz, Poland). Int. Urol. Nephrol.; 5: No. 4, 377-382(1973).

A scintigraphic estimation was made of the reduction of renal irradiation by Unithiol (USSR) on the basis of previous investigations. It was found that at 7 days following Unithiol administration the intensity of radiation over both kidneys was significantly reduced in comparison with the control group of patients (without Unithiol). Unithiol appeared to markedly reduce renal irradiation during ^{203}Hg Chlormerodrin scintigraphy. (auth)

17556 US TRANSURANIUM REGISTRY STUDY OF THIRTY AUTOPSIES. Norwood, W. D.; Newton, C. E. (Hanford Environmental Health Foundation, Richland, WA). Health Phys.; 28: No. 6, 669-675(Jun 1975).

To aid in the evaluation of biological effects of transuranium radioisotopes in people, some 850 transuranium workers have now agreed to allow autopsies. Many more are expected to cooperate. Results of the first 30 autopsies reported to the Registry are discussed. Where the estimated systemic body burden of plutonium based on urinalysis was greater than 5% of the permissible (0.04 μCi), this estimate was higher than that obtained by laboratory analysis of whole organs or parts of organs in a large majority of cases. For depositions less than 5% maximum permissible body burden, there was considerable variation depending upon individual AEC contractor reporting practices. Nonuniformity within organs was sometimes great, so whole organs (such as lungs, liver, kidneys, spleen, etc.) were usually obtained in the last 30 cases. In relatively high deposition cases (>0.02 μCi), as many as 40 organs were sampled in an effort to determine validity of applying animal data to man. The number of times that various organs had the highest concentration is tabulated. (auth)

17557 CHROMOSOMAL FINDINGS IN PATIENTS TREATED WITH SMALL DOSES OF IODINE-131. Blackwell, N. (MRC Population Genetics, Headington, Eng.); Stevenson, A. C.; Wiernik, G. Mutat. Res.; 26: No. 3, 397-402(Dec 1974).

Chromosomal analyses were made from lymphocytes of 31 patients who had been treated with relatively small oral doses of iodine-131 for hyperthyroidism. Three of these patients had been tested before and after the treatment. Doses, single or repeated, ranged from 5 to 12 mCi. Forty-eight hour cultures were used and only aberrations attributable to damage in vivo were scored. The amount of chromosomal damage was significantly greater than in controls, but not as high as found from similar amounts of activity in other radioisotopes administered by other routes. (NL)

17558 TOBACCO RADIOACTIVITY AND CANCER IN SMOKERS. Martell, E. A. (National Center for Atomspheric Research, Boulder, CO). Am. Sci.; 63: No. 4, 404-412(1975).

The recent finding that ^{210}Pb, which also is present in inhaled mainstream smoke, is highly concentrated in a small number of insoluble smoke particles changes the whole complexion of the problem of possible health effects of the inhaled radioactivity in cigarette smoke. Because ^{210}Pb has a radioactive half-life of 22 years, the body burden of the radioactive ^{210}Pb and its radioactive daughter products ^{210}Bi and ^{210}Po can continue to build up throughout the period of smoking. Alpha interactions with chromosomes of cells surrounding these insoluble radioactive smoke particles may cause cancer and contribute to early atherosclerosis development in cigarette smokers. (ERB)

Animals

17559 (BNWL-1950(Pt. 4), pp 85-89) NUCLEAR POWERED PROSTHESES. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

The totally implantable artificial heart will dissipate waste heat. $^{238}Pu^{16}O_2$ heat sources were implanted in the thorax (50-watt) and abdomen (29-watt) of miniature swine, one of the latter being temporarily cooled by an external percutaneous coolant loop to control surface temperatures during the tissue ingrowth period. Large discoid and smaller right parallelopiped (flat plate) devices were designed, fabricated, and implanted for the study of tissue heat conductance and tolerance at various surface heat flux levels. It appears that device-tissue interface temperatures of 108°F and fluxes of at least 30 mW/cm^2 are tolerable once tissue ingrowth has occurred. At least one month following implantation is required for this state to be reached. (auth)

17560 (UR-3490-778) UNIVERSITY OF ROCHESTER BIOMEDICAL AND ENVIRONMENTAL RESEARCH PROJECT: BRIEF DESCRIPTION OF RESEARCH PAPERS ACCEPTED FOR PUBLICATION DURING 1974. Annual Report. Neuman, W. F. (Rochester Univ., N. Y. (USA)). 16 Jun 1975. Contract E(11-1)-3490. 132p. Dep. NTIS $5.45.

Brief descriptions of research papers are presented under the following headings: internal emitters and mineral metabolism; aerosols; inhalation; cancer research; toxicology and membrane function; chemical toxicity; animal radiobiology; radiation toxicity; molecular genetics; and molecular and cellular radiobiology. (HLW)

17561 ^{3}H-5-IODO-2′-DEOXYURIDINE TOXICITY PROBLEMS IN CELL PROLIFERATION STUDIES. Dethlefsen, L. A. (Univ. of Utah, Salt Lake City). Cell Tissue Kinet.; 7: 213-222(1974).

The toxicity of ^{3}H-5-iodo-2′-deoxyuridine (^{3}H-IUdR) was evaluated by injecting tumor-bearing C3H mice with different concentrations of ethanol (the solvent), different doses of tritium tagged onto either IUdR or thymidine, and different chemical doses of IUdR, and then measuring the ^{3}H-IUdR incorporation into duodenal and mammary tumor DNA as well as the cellular kinetics of duodenal crypt cells. Ethanol (37% or less, 0.2 ml/mouse) did not significantly inhibit IUdR incorporation into DNA, and the incorporation after a tritium dose of 75 μCi ^{3}H-IUdR/mouse (about 3 μCi/g body weight) was not less than the incorporation following an injection of 25 μCi ^{3}H-IUdR/mouse when the IUdR dose was below 0.005 μmole per mouse. The toxic effects were primarily due to chemical toxicity from IUdR per se. Some of the duodenal cells containing IUdR apparently undergo only one post-labeling division and the generation time ($\bar{T}_c$) of the cells containing IUdR (25 μCi ^{3}H-IUdR/mouse) is 15.3 hr as compared to 13.3 hr for cells labeled with ^{3}H-TdR (75 μCi/mouse). (auth)

17562 HISTOLOGICAL CHANGES OF THE OVARY AND THE UTERUS OF GUINEA PIGS ADMINISTERED RADIOIODINE. Lee, H. S. Korean J. Vet. Res.; 13: No. 1, 1-4(1973).

The effects of ^{131}I on the uterus and the ovary of guinea pigs were studied. The animals were injected with a single dose of 4.5 mCi of radioiodine per kg of body weight. They were sacrificed on various time intervals; 1, 7, 14, 28, 42, and 56 days after the injection. The results were as follows: In the ovary, the follicle cells and the ova were degenerated with lapse of time after the injection. In the uterus, hyperplasia of the lamina propria of the endometrium and atrophy of the myometrium were observed in accordance with time after the injection. (Korean Sci. Abstr.)

17563 HEPATIC CHOLANGIOCARCINOMA IN SYRIAN HAMSTER INDUCED BY THOROTRAST ADMINISTRATION. Okamoto, T. (Kanagawa Prefectural Adult Disease Center (Japan)). Nippon Igaku Hoshasen Gakkai Zasshi; 34: No. 4, 254-266(Apr 1974). (In Japanese).

By systemic Thorotrast administration via sublingual vein, hepatic cholangiocarcinoma was induced in Syrian hamsters. The tumors were transplantable and able to be transformed into the ascitic form. Chronological observation of the tumorigenic process by histology and autoradiography demonstrated that thorotrast deposition in the liver elicit large number of perifocal fibrosis followed by adenomatous proliferation of intrahepatic bile ducts and on the basis of the above cataplastic change produced by local radiation energy of thorium, the hepatic cholangiocarcinoma might develop. The incubation period of tumor incidence showed dose-dependency of thorotrast administered. (auth)

17564 EFFECTS OF POLLUTION ON FRESHWATER FISH. McKim, J. M.; Christensen, G. M.; Tucker, J. H.; Benoit, D. A.; Lewis, M. J. (National Water Quality Lab., Duluth, MN). J. Water Pollut. Control Fed.; 46: 1540-1591(Jun 1974).

Various aspects of pollution effects on fishes are reviewed under the following headings: methodology; water quality; pesticide pollutants; industrial pollutants; domestic pollutants; radioactive pollutants; and other pollutants. A table is presented to show acute and chronic toxicity of inorganic and organic pollutants to freshwater fish. (HLW)

Nuclide Kinetics and Toxicology

Refer also to abstracts 17200, 17203, and 17206.

Man

Refer also to abstracts 17541, 17555, 17601, and 17625.

17565 (BNWL-1950(Pt. 4), pp 40-43) INSTRUMENTATION FOR MEASURING IN VIVO PLUTONIUM. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

A major problem in radiation protection in nuclear industries is the assessment of location and amount of plutonium in humans after accidental exposure. Instrumentation development and techniques tested in animals for more sensitive detection of plutonium are discussed. The methods include external counting using gas scintillation proportional counters, the determination of ^{239}Pu by measuring fission gases in expired air following neutron irradiation, and the use of a fiber-optic coupled intra-esophogeal probe. (CH)

17566 (SGAE-2251) MONITORING OF THE PERSONNEL OF THE SEIBERSDORF RESEARCH CENTER WITH A SIMPLE BODY COUNTER. Steger, F.; Schoenfeld, T.; Hefner, A. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz). Mar 1974. 18p. (In German). (CONF-7309139-1). Dep. NTIS (US Sales Only) $4.00.

From annual conference of the Austrian Society for Radiation Protection; Vienna, Austria (22 Nov 1973).

A whole-body counter was developed for use in the monitoring of personnel of the Seibersdorf Research Center. Calibration curves for the counter were obtained using phantoms containing a radioactive standard solution. Results obtained in the use of the counter for personnel monitoring are given and discussed. (ERB)

17567 STRONTIUM-90 IN HUMAN BONE IN NORWAY 1956–1972. Christensen, G. C.; Alstad, J.; Kvaale, E.; Pappas, A. C. (Univ. of Oslo). Health Phys.; 28: No. 6, 677-684(Jun 1975).

The levels of ^{90}Sr in human bone samples (vertebrae) from Norway during the period 1956 to 1972 are reported, including a detailed description of the radiochemical procedures used. The majority of the samples originates from the Oslo region. The results are classified according to the following age groups: 0 to 14 days (included stillborn), 15 days to 1 yr, >1 to 5 yr, >5 to 20 yr, and >20 yr. Of these, the second and third age group show the highest mean contamination. The highest single value, 24.6 pCi ^{90}Sr/g Ca, was found in a sample from a 6½ month old boy from Trondelag, who died in 1965. The bone/milk ratio is calculated for 99 samples of the age group >½ to 2 yr. The individual ratios show considerable scattering. Further, the yearly mean ratio varies with time, which may be a consequence of the changing fallout situation during the time of this investigation. The overall mean value of the bone/milk ratio during the years 1956 to 1972 is 0.34. (auth)

17568 COMMENTS ON "EXCHANGE KINETICS AND DOSIMETRY ON TRITIUM OXIDE IN MAN FOR DIFFERENT ROUTES OF ADMINISTRATION". McMillan, R. C. (Army Mobility Equipment Research and Development Center, Fort Belvoir, VA). Health Phys.; 28: No. 6, 826-827(Jun 1975).

Reference is made to a paper entitled "Exchange Kinetics and Dosimetry of Tritium Oxide in Man for Different Routes of Administration" Balanov et al (Health Phys.; 27: 367 (1974)) in which a useful explanation was provided of the incorporation of tritium into various compartments of the body. In this letter, a discrepancy in the use of symbols within the paper is identified and an explanation of the problem the authors encountered in balancing the hydrogen exchange is offered. (UK)

17569 REMOVAL OF PARTICLES FROM THE NASOPHARYNGEAL (NP) COMPARTMENT OF THE RESPIRATORY TRACT BY NOSE BLOWING AND SWABBING. Hounam, R. F. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Health Phys.; 28: No. 6, 743-750(Jun 1975).

Following the inhalation of γ- and high energy β-emitting material, lung content can be determined by counting in vivo. For radionuclides with less penetrating radiation, however, lung burdens cannot generally be measured with adequate sensitivity by this technique and indirect methods must be resorted to. In this paper, the percentage of an inhaled aerosol deposited in the nasopharyngeal region of the respiratory tract, which can be discharged either by nose blowing or by nose swabbing, was measured and mean values of 16.5 and 18.2% respectively were obtained. Roughly 30% was removed by the combined operations. The results appear to be independent of the size of the particles, the rate of inhalation and, for limited periods, the time elapsing after administration. (auth)

17570 STABLE IODINE REQUIREMENTS FOR THYROID GLAND BLOCKAGE OF IODINATED RADIOPHARMACEUTICALS. Wood, D. E. (Toronto General Hospital); Gilday, D. L.; Kellam, J. J. Can. Ass. Radiol.; 25: No. 4, 295-296(Dec 1974).

Stable iodine is frequently administered when non-thyroidal imaging is performed with radioactive iodine to reduce the radiation dose to the thyroid. The appropriate dose is estimated and time interval between stable and radioactive isotopes as 40 mgm of potassium iodide is calculated as any time between the time of administration of radioactive iodine administration and six hours after the radiopharmaceutical is given. (auth)

17571 IN VIVO ^{75}Se BINDING TO HUMAN PLASMA PROTEINS AFTER ADMINISTRATION OF $^{75}Se^{32}O$. Burk, R. F. (Letterman Army Inst. for Research, Denver). Biochim. Biophys. Acta; 372: No. 2, 255-265(5 Dec 1974).

Binding of ^{75}Se to plasma proteins was studied on four cancer patients who received 200 to 250 μCi of $^{75}SeO_3^{2-}$ (1.25 μg of selenium) intravenously for tumor scans. During the hour after injection, the ^{75}Se disappeared rapidly from the plasma. Gel filtration chromatography and dialysis experiments indicated that a large amount of the ^{75}Se returned to the plasma bound to protein between 1 and 6h after injection. Up to 16% of the plasma ^{75}Se was found in very-low-density lipoproteins and low-density lipo-

proteins as early as 3 min after injection but very little ^{75}Se was found in high-density lipoproteins. The very low-density lipoprotein ^{75}Se activity declined very rapidly whereas low-density lipoprotein ^{75}Se activity fell more slowly. Zonal ultracentrifugal studies of one subject's lipoproteins revealed a continuum of ^{75}Se-binding proteins from the very low-density lipoprotein peak to the low-density lipoprotein peak. Most of the ^{75}Se could be removed from the lipoproteins by denaturation with 8 M urea or treatment with 0.5 M mercaptoethanol. These treatments removed very little of the ^{75}Se from plasma collected 48 h after injection indicating a different type of binding of selenium in lipoproteins than in other plasma proteins. (NL)

17572 THE EXTRAHEPATOSPLENIC DISTRIBUTION RATIO OF ^{198}Au-COLLOID IN DIFFUSE HEPATIC DISEASE. Aburano, T.; Suzuki, Y.; Hisada, K. (Kanazawa Univ. (Japan). School of Medicine); Matsudaira, M. Kaku Igaku; 11: No. 4, 465-470 (Aug 1974). (In Japanese).

The ratio of the extrahepatosplenic distribution to systemic distribution of ^{198}Au-colloid was calculated in 52 various liver diseases to improve the diagnosis of the cirrhosis in nuclear medicine. The linear scanning of the whole body with isosensitive rectilinear scanner was performed for this purpose. The ratio showing the value higher than 20% suggested the probability of cirrhosis, because most of other diffuse hepatic diseases showed the ratio less than 20%. Twenty-three of 25 cirrhosis cases (92%) could be detected with both the extrahepatosplenic distribution ratio and a simple quantitative evaluation criterion, in contrast with fourteen of 25 cases (56%) with a simple quantitative evaluation only. The extrahepatosplenic ratio was fairly correlated with the degree of liver functional impairment, e.g., BSP (45 min.), ICG (15 min.), serum albumin and total cholesterol values, and abnormal liver scan findings, e.g., splenic activity, bone marrow activity, and patchy distribution of liver and/or increased background activity. In relation to the clinical manifestations of portal hypertension, the extrahepatosplenic ratio showed much higher value in the presence of these manifestations, and in these cases, lung visualization was frequently found on ^{99m}Tc-sulfur colloid liver scan. From these results, the quantitative evaluation of systemic ^{198}Au-colloid distribution state is supposed to be one of the most valuable means to improve the diagnosis of the cirrhosis in nuclear medicine and to predict the state of portal hypertention or portosystemic collateral circulation. (auth)

Animals

Refer also to abstracts 16698, 16898, 16902, 17205, 17458, 17459, 17516, 17560, 17594, and 17629.

17573 (CEA-R-4658) EXPERIMENTAL STUDY OF THE TRANSFER OF ^{60}Co BETWEEN A MARINE ANNELID ARENICOLA MARINA L. AND ITS PREDATORS: THE CRAB CARCINUS MAENAS L., THE PLAICE PLEURONECTES PLATESSA L. Amiard-Triquet, C.; Amiard, J. C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service de Recherches Toxicologiques et Ecologiques). Mar 1975. 50p. (In French). Dep. NTIS (US Sales Only) $5.50.

The absorption and urinary, branchial, and fecal excretions of ^{60}Co resulting from the administration of contaminated food were followed in crabs and plaices between one and five months. Elimination following immersion of the animals in uncontaminated water was observed in the crabs and plaices for six and three months respectively. Assimilation rates of radiocobalt and stable cobalt as a carrier were different according to species: high in Carcinus, very low in Pleuronectes. Uptake of cobalt isotopes occured mainly in the crabs' hepatopancreas and in the plaices' liver and kidneys. On account of the high concentration of ^{60}Co in these organs, there may result for these species internal exposures highly localized but fairly strong and long-lasting as cobalt seems to be retained in a hardly exchangeable form. (auth)

17574 (CONF-750503-24) COMPARATIVE RETENTION OF ^{60}Co, ^{109}Cd, AND ^{137}Cs FOLLOWING ACUTE AND CHRONIC FEEDING IN BOBWHITE QUAIL. Anderson, S. H.; Dodson, G. J.; Van Hook, R. I. (Oak Ridge National Lab., Tenn. (USA)). 1975. 14p. Dep. NTIS $4.00.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

Tissue distribution of the radionuclides were found in the groups given the chronic exposure. Under chronic exposure to ^{60}Co, ^{109}Cd, and ^{137}Cs, quail rapidly accumulated these radioisotopes and the respective body burden concentrations began to level off after 11, 21, and 21 days of exposure. The biological half-lives for radioisotopes accumulated during the chronic feedings were 13 days for ^{60}Co, 8 days for ^{109}Cd, and 11 days for ^{137}Cs. In contrast, biological half-lives for these radioisotopes under acute feeding conditions (single four-hour feeding) were 15 days for ^{60}Co, 3 days for ^{109}Cd, and 10 days for ^{137}Cs. These results indicate that food chain behavior of ^{60}Co and ^{137}Cs in Bobwhite is similar following either acute or chronic exposure to contaminated food. For ^{109}Cd, biological retention in Bobwhite was longer under chronic exposure conditions. (auth)

17575 EFFECTS OF A LOW LEVEL OF DIETARY CADMIUM ON SOME BIOCHEMICAL AND PHYSIOLOGICAL PARAMETERS IN RATS. Doyle, J. J.; Bernhoft, R. A.; Sandstead, H. H. (Univ. of North Dakota, Grand Forks). pp 403-409 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

The effects of 5 mu g Cd/ml of drinking water on body weight gain, feed intake, systolic blood pressure, serum cholesterol, ^{24}Na and ^{42}K retention in male and female rats were studied. After 205 days, cadmium had no significant effect on weight gain, feed intake, water intake or feed efficiency. In vivo retention of ^{24}Na was greater in Cd treated males and females at 161 days than in controls and was significantly greater (P less than 0.05) in Cd treated females than in control females at 294 days. In vivo retention of ^{42}K was significantly greater in Cd treated males than in control males at 189 days, but the opposite was true of Cd treated females in comparison with female controls. No significant differences were found between treatments in systolic blood pressure or serum cholesterol. There were highly significant differences (P less than 0.01) in intakes of NaCl for control and Cd fed males at 269 days. (auth)

17576 EXPERIMENTAL ENDOCRINE EXOPHTHALMOS. I. Effect of TSH on S35 Sulfate Uptake. Haddad, H. M.; Loucas, S. P.; Haddad, H. (New York Medical Coll., NY). Ann. Ophthalmol.; 6: 721-725(Jul 1974).

The distribution of ^{35}S-sulfate in the goldfish was studied. The goldfish responds to TSH stimulation with a proptosis and with an increase in radiosulfate incorporation particularly to the systemic muscle, the intestine, and orbital tissues and most remarkably 72 hours rather than 24 hours after radiosulfate administration. Exophthalmos in the fish was readily produced after the administration of 0.1 units of TSH on two successive days. The effect of TSH on radiosulfate incorporation in the orbital tissues appears to be not as significant as that on the systemic muscle where it is significantly and persistently increased by TSH stimulation. (auth)

17577 COMMENTS ON "COMPARATIVE DISTRIBUTION AND EXCRETION OF ^{237}Pu AND ^{239}Pu NITRATES IN BEAGLE DOGS". Moghissi, A. A.; Carter, M. W. (Georgia Inst. of Tech., Atlanta). Health Phys.; 28: No. 6, 825-826(Jun 1975).

Reference is made to an article by Bair et al (Health Phys.; 25: 392 (1974)) entitled "Comparative Distribution and Excretion of ^{237}Pu and ^{239}Pu Nitrates in Beagle Dogs", in which the differences in biological behavior of the two isotopes which was found, was identified as due to the difference in masses of material used for the same quantity of radioactivity. The present authors extend the warning given in the original paper against the pitfalls of using one isotope in places where the other isotope may be more appropriate, to those plutonium studies that may be applied to environmental studies. It is suggested that experiments with ^{239}Pu, and to some extent with ^{238}Pu, at microcurie and higher levels are not necessarily applicable to environmental kinetics of ^{239}Pu at picocurie or lower levels and may, in fact, be misleading. (UK)

17578 INHALATION OF ^{181}W LABELED TUNGSTIC OXIDE BY SIX BEAGLE DOGS. Aamodt, R. L. (Univ. of Rochester, NY). Health Phys.; 28: No. 6, 733-742(Jun 1975).

Six purebred beagle dogs were exposed to 1.9 to 8 μCi of $^{181}WO_3$ by nose inhalation. The aerosol had an activity median aerodynamic diameter of 0.70 μm and a geometric standard deviation of 1.5. The activity deposited in the respiratory tract of each animal was estimated by three independent techniques. Retention and excretion were measured over 165 days. Following inhalation, 60% of the inhaled activity was deposited in the respiratory tract. Of this, about half was located, by γ spectroscopy, in the lower portion of the tracheobronchial compartment and in the pulmonary compartment. Removal of the inhaled activity from the body was quite rapid. Partial body retention was determined from in vivo γ counting over the lung area and over the posterior portion of the dog's body. Whole-body retention was also estimated by subtracting the excreted activity from the inhaled activity at various times. The ratio of cumulative urinary excretion to cumulative fecal excretion for 165 days ranged from 0.57 to 1.8. Blood measurements indicated that the inhaled tungstic oxide entered the blood quite soon after inhalation and was rapidly removed. Measurements of selected organ and tissue samples at sacrifice (165 days post-inhalation) showed the highest concentration of tungsten in

lung and kidney. In terms of total organ burdens, most of the activity was found in bone (37%), lung (31%), kidney (15%), liver (9.7%), and skeletal muscle (5.7%). Body burdens calculated from organ and tissue burdens were in good agreement with in vivo γ measurements at sacrifice. (auth)

17579 ABSORPTION, DISTRIBUTION, AND MILK SECRETION OF RADIONUCLIDES BY THE DAIRY COW. IV. Inorganic Radiomercury. Mullen, A. L.; Stanley, R. E.; Lloyd, S. R.; Moghissi, A. A. (National Environmental Research Center, Las Vegas, NV). Health Phys.; 28: No. 6, 685-691(Jun 1975).

Four lactating cows were confined in metabolism stalls and each given a single oral dose of $Hg(NO_3)_2$. For the next 10 days, all milk, urine and feces from the four cows were collected and the ^{203}Hg content measured. Peak activity appeared in the milk 42 hr after ingestion of the radionuclide. The ^{203}Hg was eliminated by the cow with a biological half-time in milk of 131 hr. During the 10-day period after dosing, 75% of the ingested ^{203}Hg was excreted, with 0.08% recovered in the urine, 0.01% in the milk, and the remainder in the feces. In a companion study lactating cows and calves were sacrificed at various times after oral and intravenous administrations of ^{203}Hg and samples were collected to measure the tissue distribution of the radionuclide. The radiomercury was found distributed throughout the body after both intravenous and oral administrations, with the kidneys being the site of principal concentration. As indicated by the results of this study, inorganic radiomercury is sparingly absorbed from the intestinal tract of the dairy cow and the urinary system is the preferred route of excretion for the absorbed radiomercury. (auth)

17580 STUDIES ON THE ARTIFICIAL RADIOACTIVITY OF FISH IN 1967–1968. Randow, F.; Schulze, H. A. (Rostock Univ., Ger.). Nahrung; 15: No. 1, 81-89(1971). (In German).

The total β, ^{90}Sr, and ^{137}Cs activity of the meat of fresh water fish from lakes in the vicinity of Mecklenburg and of salt water fish from the Baltic Sea and the north Atlantic was determined in 1967 and 1968. The total β activity of the samples was 2100 to 3100 pCi/kg. The radiochemical analysis gave an average contamination for bream (Abramis brama) of 6 pCi ^{90}Sr/kg and 332 ^{137}Cs/kg and for pike (Esox lucius) 2 pCi ^{90}Sr/kg and 450 pCi ^{137}Cs/kg. Salt water fish has a ^{90}Sr content of 1 to 7 pCi/kg and a ^{137}Cs content of 120 pCi/kg for fish from the Baltic Sea and 24 pCi/kg for those from the north Atlantic. The ^{90}Sr content of the bones of Baltic Sea fish was 1.0 to 2.2 pCi/g of Ca and 4.0 to 6.4 pCi/g of Ca for fresh water fish. The population of the northern regions received an additional 22 pCi of ^{90}Sr and 1120 pCi of ^{137}Cs from fish consumption per person and year, which is approximately 0.1% of the maximum permissible activity intake. (tr-auth)

17581 INHIBITION OF ^{137}Cs UPTAKE IN LAYERS [HENS]. Nezel, K. (Bundesforschungsanstalt fuer Kleintierzucht, Celle, Ger.). pp 138-156 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

Presaturation of the organism of Leghorn hens by inactive Cs has no influence upon the following uptake of ^{137}Cs. Isotope dilution of radioactive ^{137}Cs by inactive Cs does not diminish the incorporation of the radionuclide. The enhancement of the excretion of ^{137}Cs in hens by $NH_4Fe[Fe(CN)_6]$ is not very important. The effective halflife is only shortened about 20%. But this substance is able to inhibit almost completely the uptake of ^{137}Cs when given together with the contaminated food. Eggs as well as meat contained almost no ^{137}Cs although food eaten contained 15 nCi/kg of the radionuclide. (auth)

17582 MODIFICATION OF THE CONTAMINATION OF MEAT BY FEEDING PRECAUTIONS IN ANIMALS TO BE BUTCHERED. Mirna, A. (Bundesanstalt fuer Fleischforschung, Kulmbach, Ger.). pp 157-165 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The effect of the addition of various clays to the food of guinea pigs and piglets on the retention of ^{137}Cs, $^{144}Ce/^{144}Pr$, and ^{90}Sr was studied. The ^{137}Cs activity of the musculature was significantly reduced. The activity of the skin was not affected and that of the bones was only modified slightly, not to a statistically significant degree. (JSR)

17583 SURFACE DECONTAMINATION OF LABORATORY ANIMALS. Mirna, A.; Egginger, R.; Hering, G. (Bundesanstalt fuer Fleischforschung, Kulmbach, Ger.). pp 258-272 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs- und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

The decontamination efficiency of plain tap water and two detergent solutions was studied on guinea pigs with surface contamination by ^{137}Cs, ^{85}Sr, $^{144}Ce/^{144}Pr$, and $^{95}Zr/^{95}Nb$. The results showed that ^{85}Sr and $^{144}Ce/^{144}Pr$ are rapidly removed by washing with neutral solution; the other two isotopes are not as readily removed because of their absorption into the skin, particularly ^{137}Cs. The residual radioactivity is principally in hair. The detergent solutions were more effective in decontamination, but there was little significant difference in the two detergents. Shaving is an effective decontamination method, but is suitable only for small animals. (JSR)

17584 ABSORPTION OF ZINC-65 AND COPPER-64 IN ZINC DEFICIENCY. Schwarz, F. J.; Kirchgessner, M. (Univ., Munich). Int. J. Vitam. Nutr. Res.; 44: 258-266(7 Mar 1974). (In German).

Studies on the absorption of zinc-65 and copper-64 in Zn deficiency were conducted. Growing male Sprague-Dawley rats were depleted of zinc by feeding a Zn-deficient casein diet (3,5 ppm zinc) over a period of 22 days. The diet of ad libitum fed control rats contained 25 ppM zinc and the diet of pair-fed animals 40 ppM. Cu content in the diets for the Zn depletion and pair-fed rats was doubled to 10 ppM, in comparison to that for the ad libitum fed control rats. At the end of the depletion ^{65}Zn-$ZnCl_2$ or ^{64}Cu-$CuCl_2$ were administered with a stomach tube and their absorption was measured after one hour by their uptake into blood, liver, kidneys and intestine. The ^{65}Zn uptake into blood, liver and kidneys of the Zn-depleted rats amounted to 13,4% of the administered dose and was distinctly higher than the corresponding values of 7.4 and 4.8% for the ad libitum fed and the pair-fed control groups ($P < 0.05$ and $P < 0.01$). The Zn uptake by the intestinal wall of the Zn-deficient rats was twice as high as that of the ad libitum fed control rats ($P < 0.01$) and four times that of the pair-fed animals ($P < 0.001$). Zn deficiency also caused ^{64}Cu absorption into blood, liver and kidneys to greatly increase to a total of 6.7% of the dose compared to 3.1 and 4.5% in ad libitum and pair-fed controls ($P < 0.05$). The ^{64}Cu activity of the Zn-depleted intestines was significantly higher than that of the Zn-supplied control groups ($P < 0.01$). From these results it was concluded that there must be a real interaction between zinc and copper in their absorption and binding by the intestinal wall. (auth)

17585 STUDY OF THE CIRCULATION IN THE INTERNAL ORGANS OF MICE USING RADIOACTIVE RUBIDIUM. Kulinskii, V. I.; Zolochevs'ka, L. I. Fiziol. Zh., Akad. Nauk Ukr. RSR; 20: 260-263(1974). (In Ukrainian).

The dynamics of the accumulation of ^{86}Rb in the liver, spleen, small intestine, and skeleton muscles of mice were studied using a modification of the Sapirsten method. The results are tabulated for the first 60 sec after injection. The effects of adrenaline, noradrenaline, and serotonin one the accumulation dynamics were determined. Small doses of adrenaline and noradrenaline do not affect the blood flow dynamics. With increase of the dose of noradrenaline the blood flow is decreased first in the muscles and then in intestine and spleen. Serotonin at high doses sharply decreases the blood flow in the muscle and spleen, but does not cause changes in the liver. Small doses of adrenaline does not affect the blood flow in the bone marrow, but even small doses of noradrenaline increase it some. (JSR)

Plants

Refer also to abstract 17202.

17586 IODINE-125 ACCUMULATION IN PLANT PARTS: INFLUENCE OF WATER USE RATE AND STABLE IODINE CONTENT OF SOIL. Cline, J. F.; Klepper, B. (Battelle Pacific Northwest Labs., Richland, WA). Health Phys.; 28: No. 6, 801-804(Jun 1975).

Soil-plant concentration factors for radioiodine are needed for dose-to-man calculations resulting from ^{129}I, a fission product that has a sufficiently long half-life that it will become a part of the iodine pool of the biosphere. Eight species grown in pots containing soil amended with Na ^{125}I were studied. Radioiodine was either applied carrier-free or it was applied along with NaI to give 5, 10 and 15 ppM iodine. Concentration factors (μCi per g DW plant/μCi per g DW soil) varied with plant species, leaf age, and soil iodine concentration. Factors ranged from 0.05 for young lettuce leaves in soil amended with carrier-free Na ^{125}I to 609 for older spinach leaves growing in soil with 15 ppM I. There was no apparent correlation between water use and radioiodine content of shoots. (auth)

17587 UPTAKE OF RADIONUCLIDES IN GRAINS. Nierle, W.; Ocker, H. D. (Bundesforschungsanstalt fuer Getreideverarbeitung, Detmold, Ger.). pp 42-57 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

After an explanation of root and leaf uptake of radioisotopes, studies were described in which summer wheat and winter rye were artificially labelled with carrier-free solutions of ^{85}Sr, ^{54}Mn, ^{60}Co, and ^{134}Cs at different growth periods. The effects of the different labelling times on the deposition of the radionuclide in the grain and the distribution within the grain were studied. The results are tabulated. (JSR)

17588 DECONTAMINATION OF GRAINS. Ocker, H. D. (Bundesforschungsanstalt fuer Getreideverarbeitung, Detmold, Ger.). pp 177-196 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.). Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

A review is given of the decontamination of grains by washing and shelling or husking. Washing with water, washing with water to which various acids had been added, mechanical shelling or husking, dry shelling, and chemical shelling are discussed. It is concluded that the decontamination of grains is quite difficult because the high polymers constituting the grain bind the nuclides so strongly that removal is difficult with severe modification of the structure or quality of the grain. (JSR)

17589 DECONTAMINATION OF PLANT FOODS, ESPECIALLY FRUIT AND VEGETABLES, AND THE PROBLEMS ASSOCIATED WITH IT. Paulus, K. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). pp 197-228 of Kontamination und Dekontamination von Lebensmitteln. Fischer, E. (ed.) Bonn; AID (Land- und Hauswirtschaftlicher Auswertungs-und Informationsdienst e.V. (1974)). (In German).

From symposium on contamination and decontamination of food; Karlsruhe, F. R. Germany (2 Jun 1970). See CONF-700685-.

In order to determine the optimum methods for the decontamination of fruits and vegetables, studies were made on the tissue transport of ^{137}Cs, ^{85}Sr, ^{95}Zr, and ^{144}Ce in potato slices and on possible methods of artificially contaminating fruits and vegetables. Growing plants were contaminated by spraying or injection and harvested plants by immersion in active solutions or injection. The results showed that Cs and Sr vary greatly in their mobility in the plant tissues, but the degree of contamination also depends on the type of tissue, the geometry of the sample, and the contamination time. Results obtained in the decontamination of surface-contaminated leafy vegetables, cabbages, roots, tubers, legumes, berries, and stone fruits are summarized from previously reported test data. Alterations in the foods as a result of the decontamination procedures are briefly considered. (JSR)

17590 ACCUMULATION AND TRANSLOCATION OF K^+, Na^+, AND Ca^{2+} SUPPLIED TO THE DIFFERENT ROOT ZONES OF CORN SEEDLINGS. Marschner, H.; Richter, Ch. (Technische Univ. Berlin (F. R. Germany). Inst. fuer Pflanzenernaehrung). Z. Pflanzenernaehr. Bodenkd.; 135: No. 1, 1-15(1973). (In German).

8 tabs.; 38 refs.

In various distances from the tip of the primary root of 9-day old corn seedlings, nutrient solution labeled with ^{42}K, ^{22}Na, or ^{45}Ca was supplied to a 3 cm section of the root. After 24 hours, the roots were segmented and analyzed. From the treated zone, K^+ was not only translocated in direction of the shoot but also to a high degree in direction of the root tip where a pronounced accumulation of K^+ was evident. In contrast to this, most of the Na^+, which was taken up, was accumulated in the treated zone, whereas the translocation in direction of the shoot was restricted; some translocation in direction of the root tip was detectable. The accumulation of Ca^{2+} in the treated zone was less pronounced, most of the Ca^{2+} was translocated to the shoot. There was no translocation of Ca^{2+} in the direction of the root tip (phloem transport). When K^+, Na^+, or Ca^{2+} were supplied to different root zones in the region from 0 to 18 cm behind the root tip in these fast growing roots, the total uptake was the same in a range of 3 to 18 cm behind the root tip in these fast growing roots, the total uptake was the same in a range of 3 to 18 cm behind the tip. In the tip zone (0 to 3 cm) however, the uptake of K^+ was lower and the uptake of Ca^{2+} was higher than in the other root zones. For all three cations with increasing distance from the root tip, the accumulation in the treated zone decreased and the translocation from this zone in the direction of the shoot increased. The results showed the different contribution of the various root zones for translocation of ions to the shoot as well as pronounced differences in translocation between the three cations after entering a certain zone of the root. (auth)

17591 ^{203}Hg TRACER STUDIES ON MERCURY UPTAKE FROM SOIL BY WHEAT AND BARLEY. Lee, C. C. (Univ. of Saskatchewan, Saskatoon). Bull. Environ. Contam. Toxicol.; 11: No. 6, 551-553(Jun 1974).

The results of a study on the uptake of ^{203}Hg-labeled mercuric cations from the soil by wheat and barley are reported. The ^{203}Hg activity, as mercuric nitrate, was applied either in a 1.0 ml aqueous solution added as one spot near the seed or as a 25 ml solution thoroughly mixed with the soil. Uptake was significantly greater when the ^{203}Hg was thoroughly mixed with the soil. The results show that while wheat and barley do assimilate some of the added mercuric ions, the actual magnitudes of these uptakes are very small. (ERB)

New Tracer Techniques

Refer also to abstracts 16715, 16723, 16724, 16899, 16916, 17185, 17212, 17452, 17458, 17459, 17555, 17561, 17570, 17572, and 17584.

17592 (CEA-CONF-2948) DOUBLE AND TRIPLE ISOTOPE GAMMA CAMERA STUDIES WITH ENERGY SELECTION AFTER DATA COLLECTION. Soussaline, F.; Todd-Pokropek, A. E.; Raynaud, C.; Kacperek, A.; Sauce, M.; Zajde, C.; Kellershohn, C. (CEA, 91 - Orsay (France). Service Hospitalier Frederic Joliot; University Coll. Hospital Medical School, London (UK)). 1974. 5p. (CONF-740926-8). Dep. NTIS (US Sales Only) $4.00.

From 1st world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

A system comprising a Toshiba camera and an Informatek data processing system has been used to perform multiple isotope studies. A large window (30 to 550 keV) is used and the data can be manipulated after data collection, to form sets of dynamic frames for various energies. Linear combinations of matrices have been used to correct for scattering. Double isotope studies using $^{197}Hg/^{198}Au$ have been used to determine Hg renal uptake in man, and are compared to a previous technique requiring two separate data acquisitions. Animal (pig) renal experiments have been performed using $^{169}Yb/^{99m}Tc/^{197}Hg$. This pilot study gave good results and indicates the utility of the system for multiple isotope function studies in man. (auth)

17593 (CONF-750231-1) EMISSION COMPUTERIZED-TOMOGRAPHY AND DETERMINATION OF LOCAL BRAIN FUNCTION. Kuhl, D. E.; Alavi, A.; Reivich, M.; Edwards, R. Q.; Fenton, C. A.; Zimmerman, R. A. (Pennsylvania Univ., Philadelphia (USA)). 1975. 25p. Dep. NTIS $4.25.

From symposium on the past, present, and future of non-invasive brain imaging; Salt Lake City, Utah, USA (19 Feb 1975).

Methods for the three dimensional reconstruction of /sup 99m/Tc brain scans are described. The diagnostic advantages of computerized tomography in the localization of brain tumors and in measurements of local cerebral blood flow are discussed. (CH)

17594 TRACE SUBSTANCES IN ENVIRONMENTAL HEALTH. VIII. Eighth Annual Conference Held at Columbia, Missouri, June 11-13, 1974. Hemphill, D. D. (ed.). Columbia, MO; University of Missouri (1974). 470p. (CONF-740696-).

Fifty-six papers were presented on various aspects of the effects of trace substances on the environment. The papers were organized under the following main headings: epidemiology, environmental geochemistry and health, environmental pollution, analytical methodology, and health effects of trace substances. Studies on pesticide pollutants were conducted using ^{14}C, ^{3}H, ^{32}P, and ^{35}S as tracers. Mercury-203 and ^{115m}Cd were used in studies on the transfer of Hg, Cd, and Se from terrestrial to aquatic ecosystems. The transfer of methylmercury to the tissues of the rainbow trout was studied using ^{203}Hg. A study was conducted on the effects of dietary cadmium on ^{24}Na and ^{42}K retention in rats. Separate abstracts were prepared for 8 papers. (HLW)

For abstracts of individual papers see: 16710-16713, 17212, 17575, 17595, and 17596.

17595 MECHANISM OF METHYLMERCURY TRANSPORT AND TRANSFER TO THE TISSUES OF THE RAINBOW TROUT (SALMO GAIRDNERI). Giblin, F. J.; Massaro, E. J. (State Univ. of New York, Buffalo). pp 349-355 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

Hemoglobin (Hb) is the main methylmercury (Me Hg) transport protein in trout blood, binding 90 percent of whole blood MeHg as determined by gel filtration chromatography following an intragastric dose of $Me^{203}HgCl$. In vitro MeHg is taken up rapidly by red blood cells (RBC) with 84 percent of the Hg (5 ppM as MeHg) added to whole blood being accumulated by the RBCs in 3 minutes. The binding of MeHg within the RBC is freely reversible in vitro as demonstrated by the efflux of Hg from RBCs suspended in protein solutions. Trout hemolysate, containing 55 mg/ml Hb, removed 36 percent of the Hg from the RBCs in a 12 hour incubation period. The MeHg bond within the RBC is also reversible in vivo. Gel filtration chromatography of liver soluble proteins showed identical elution profiles for MeHg administered as the free salt or bound in RBCs. The number of reactive sulfhydryl (-SH) groups per molecule of Hb was found to be 4 by amperometric titration with MeHgCl. The reactive -SH concentration in the RBC was calculated to be at least 20 mM. A mechanism for the efflux of MeHg from the RBC is proposed involving the dissociation of MeHg from Hb initiated by -SH groups outside the RBC and migration of MeHg across the membrane as MeHgCl. (auth)

17596 SUPPRESSION OF SKIN RNA SYNTHESIS IN ZINC DEFICIENT RATS. Hsu, J. M.; Anthony, W. L. (Veterans Administration Hospital, Baltimore). pp 387-391 of Trace Substances in Environmental Health. VIII. Hemphill, D. D. (ed.). Columbia, MO; Univ. of Missouri (1974).

From 8th annual conference on trace substances in environmental health; Columbia, Missouri, USA (11 Jun 1974). See CONF-740696-.

Experiments were conducted on the effects of zinc deficiency on RNA metabolism in weanling rats. Results indicated that the RNA content in the skin of Zn deficient rats was significantly lower than control rats. Deficiency of Zn did not change RNA content of the pancreas, kidney, liver or testes. Zinc deficiency reduced the amount of uridine-5,6-^{3}H incorporation into skin RNA at 1 hour post-injection. No significant differences were observed in the RNA radioactivity of the pancreas, liver, kidney and testes between the two groups. However, a significant increase of uridine-^{3}H was incorporated into liver RNA in Zn deficient rats after injection of actinomycin D. Additional experiments revealed that Zn deficient rats had an increased urinary excretion of ^{14}-C after uridine-2-^{14}C injection but normal capacity in the production of expired $^{14}CO_2$. These observations suggest that Zn is essential in the regulation of RNA metabolism in mammalian tissue. (auth)

17597 CONVENIENT METHOD OF LABELLING IXODID TICKS WITH RADIO-ISOTOPES FOR FUTURE IDENTIFICATION DURING FIELD STUDIES. Branagan, D. (Centre for Tropical Veterinary Medicine, Midlothian, Scotland). Trop. Anim. Health Prod.; 3: 101-106(1971).

A convenient technique by which large numbers of ticks were labelled with ^{144}Ce, an adequately long-lived radioisotope, is described. The equipment required is neither complex nor expensive. The results from trials indicated that individual Rhipicephalus appendiculatus nymphs could be identified at a range of between 0.3 and 0.6 metres by means of a portable Geiger-Muller radiation monitor for at least three months after being labelled as engorged larvae. The advantages and disadvantages in the application of this and alternative techniques are discussed. (auth)

17598 PREPARATION AND PROPERTIES OF ^{99m}Tc–Fe HYDROXY MACROAGGREGATES AS A RADIOPHARMACEUTICAL SUITABLE FOR PERFUSION GAMMAGRAPHY OF THE LUNGS. Hrivnakova, A.; Hupka, S.; Rajniakova, L. (Onkologicky ustav pre Slovensko, Bratislava). Bratisl. Lek. Listy; 62: No. 1, 56-64(1974). (In Czech).

The contribution of perfusion scanning using ^{99m}Tc–Fe hydroxide macroaggregates to improvement of diagnosing pulmonary emboli was followed on a clinical group of patients. Perfusion scanning proved to be a successful easily performable technique and in many instances the screening diagnostic method of pulmonary emboli. Scans of the lungs, particularly the lateral views, often reveal the actual extent of perfusion disorders as well as microembolization in the parenchyma of the lungs that could not be detected roentgenographically. The improvement of perfusion under anticoagulation therapy can further be followed up by lung scans. The findings of perfusion scanning, however, has to be correlated with the anamnesis, the clinical condition, the roentgenographic findings, the electrocardiogram and, particularly in cases with chronic obstructive lung diseases, also with arteriograms. (auth)

17599 USE OF RADIOACTIVE ISOTOPES IN THE EXAMINATION OF CEREBRAL BLOOD FLOW. Szalontai, K. (Tisza Power Plant Enterprise, Leninvaros, Hungary); Rochlitz, S.; Molnar, L. Acta Physiol. Acad. Sci. Hung.; 44: No. 1, 1-10 (1973).

The ^{85}Kr and ^{133}Xe radioactive clearance technique applied for measuring cerebral blood flow is described. The procedures for the mathematical evaluation of clearance curves obtained in the course of investigations are described. A proposal is made for the application of a new mathematical method, by means of which evaluation of clearance-curves may provide data less ambiguous than those available previously. (auth)

17600 GAMMA RADIOGRAPHY OF THE SALIVARY GLANDS. Calatrava Paramo, L. (Faculty of Medicine, Madrid). An. Espan. Odontestomatol.; 33: No. 6, 453-466(1974). (In Spanish).

The diagnostic value of ^{99m}Tc scintiscanning for the localization of neoplasms of the salivary gland is discussed. (CH)

17601 METABOLISM OF ^{14}C-CORTISOL AND ^{3}H-6β-HYDROXYCORTISOL DURING THE NEONATAL PERIOD. Danillescu-Goldinberg, D.; Branchaud, C.; Arato, J.; Giroud, C. J. P. (McGill Univ., Montreal). SZ; 4: 351-360(1973).

^{14}C-cortisol and ^{3}H-6β-hydroxycortisol were administered intravenously to one single human infant aged 2 days, and the pattern of urinary metabolites analyzed and compared. Of the total amount of ^{3}H excreted 41% was extracted in the unconjugated fraction, 8.4 in the glucuronide, 3.1% in the sulfate, and 7% with butanol. 21% was unaccounted for. The corresponding figures for ^{14}C were: unconjugated, 13%; glucuronide, 17%; sulfate, 2.9%; butanol extractable, 18%; unaccounted for, 13%. The major metabolites of ^{3}H-6β-hydroxycortisol and their respective $^{14}C/^{3}H$ ratios were: 6β-hydroxycortisol (0.02); 6β-hydroxycortisone (0.07); 6β-hydroxytetrahydrocortisol (2.60), and 6β-hydroxytetrahydrocortisol glucuronide (6.0). The major metabolites of ^{14}C-cortisol were tetrahydrocortisone and α-cortolone glucuronides. They were devoid of ^{3}H. The production rate of 6β-hydroxycortisol was calculated from the specific activity of urinary 6β-hydroxycortisol in terms of ^{3}H as being 173 μg/day. The peripheral production of this steroid from cortisol, calculated from the secretion rate of cortisol (5.7 mg/day) and the ratio $^{14}C/^{3}H$ of urinary 6β-hydroxycortisol/$^{14}C/^{3}H$ of injected solution, was 131 μg/day. The data suggest that, in this infant, 6β-hydroxycortisol formation represented a minor pathway for cortisol metabolism. On the other hand, the $^{14}C/^{3}H$ ratio of 6β-hydroxytetrahydrocortisol and of at least one metabolite, partially identified in the butanol-extractable fraction, indicate that reduced metabolites of cortisol might be further metabolized via 6β-hydroxylation. (auth)

17602 FUNCTIONAL RADIOISOTOPE INVESTIGATIONS IN CHRONIC NEPHRITIS. Mitrov, G.; Majdrakov, G. Salambashev, L.; Mushmov, D. (Postgraduate Medical Inst., Sofia). Int. Urol. Nephrol.; 4: No. 4, 417-422(1972).

The results of investigation on the possibilities of kidney scanning in the diagnosis of chronic nephritis are reported. The study was carried out in 100 patients with impairment of renal function of various severity. Renal lesion was established by means of isotope nephrography with ^{131}I-hippuran and ^{51}Cr-EDTA in 63 per cent of the examined patients. In 22 of these only isotope nephrography with ^{51}Cr-EDTA showed pathological changes. The latter has a considerable priority as compared with the isotope nephrography with ^{131}I-hippuran in the diagnosis of the functional disturbances in chronic nephritis. In 51 patients the glomerular filtration rate was assessed by means of ^{51}Cr-EDTA clearance. A normal nephrogram with ^{51}Cr-EDTA associated with reduced values of glomerular filtration rate was found in 10 patients. An isosthenuric type of the tracings on the isotope nephrograms with ^{51}Cr-EDTA was established in 20 patients, in whom the glomerular filtration rate was less than 50 per cent of the normal. It is pointed out that the isosthenuric type of tracings appeared before blood retention of urea. (auth)

17603 POSSIBLE IMMUNOLOGICAL SIGNIFICANCE OF HEPATOMEGALY AND SPLENOMEGALY AS RECORDED BY THE HEPATIC GAMMA SCANNING IN PATIENTS WITH MALIGNANT MELANOMA. Ikonopisov, R. L.; Oreshkov, V. I. (Medical Academy, Sofia). Tumori; 60: No. 4, 99-104(1974).

The colloidal ^{198}Au liver and spleen scans of 100 patients with malignant melanoma, of both sexes, all age groups and various clinical stages of the disease, were compared with the scans of another 100 patients with other solid tumors (gastric, mammary, rectal, and pulmonary carcinoma). Scans revealing data for metastatic deposits to the liver and/or the spleen were discarded in this study. Results revealed that hepatomegaly was present in 42% of the melanoma patients and in 12% of the patients with all the rest of the solid tumors; splenomegaly was visualized on the

scans of melanoma patients in 37% of the cases and in only 7.4% of the whole group of patients with gastric, mammary, rectal, and pulmonary cancer. (auth)

17604 FURTHER STUDIES ON THE ISOTOPE MODIFICATION OF THE MIXED HEMADSORPTION TECHNIQUE. Factors Influencing the Prozone Effect. Sundqvist, K. G. (Karolinska Inst., Stockholm). Scand. J. Immunol.; No. 3, 251-260(1974).

The isotope modification of the mixed hemadsorption technique (IMHT) is a sensitive quantitative assay for studies of antigen-antibody interaction at the cell surface. This interaction is recorded by isotope-labeled indicator cells adhering to antibody bound to the target cell. The intensity of the adherence of indicator cells in counts per minute is plotted versus antibody concentration, which gives a reaction curve. When IMHT was applied to different antigen-antibody systems, these reaction curves differed with regard to their tendency to prozone effect. Test systems involving histocompatibility (H-2, HL-A) or organ antigens showed a pronounced prozone effect. In contrast, those involving species and blood group antigens showed relatively weak prozone effect. Some factors presumed to exert an influence on the reactivity in IMHT, especially the prozone effect, are analyzed. (CH)

17605 DEVELOPMENT OF A RAPID RADIOIMMUNOLOGICAL DETERMINATION OF GONADOTROPHINES. Reuter, A. M. (National Inst. of Radioelements, Fleurus, Belgium); Hendrick, J. C.; Franchimont, P. Rev. IRE; 1: No. 2, 9-16(Jun 1974). (In French).

Three methods of separation of the Ag*—Ac and Ag* complex were studied using radioimmunoassay of FSH, LH and HCG. Compared with immunoprecipitation, the use of an antihormone antibody immunoadsorbant represents a less sensitive technique that is less precise and less influenced by serum proteins. On the other hand, the use of an anti-γ-globulin immunoadsorbant to separate the antigen-antibody complex represents a technique as sensitive and precise as immunoprecipitation. The influence of serum proteins is very low using this technique. (auth)

17606 TUMOR LOCALIZATION WITH RADIONUCLIDES. Benua, R. S. Clin. Bull.; 3: No. 2, 49-53(1973).

Neoplasms in the intact patient can be detected either by the uptake of a radiopharmaceutical in the tumor or by the detection of a void created by a new growth within an organ which normally collects the radionuclide. The most familiar example of tumor detection by its own uptake of the radionuclide is in brain scanning. Here, the diffusion of materials such as /sup 99m/Tc pertechnetate into a lesion contrasts with the lack of such diffusion into the surrounding normal brain. The uptake is thought to be due to a breakdown of the blood-brain barrier, although increased vascularity has also been invoked to explain this phenomenon. This uptake is not specific for neoplastic disease as it also occurs in areas of infarction or abscess. The relative sensitivity and specificity of various configurations of uptake in the brain may lead to informed guesses as to the nature of the lesion. Other radiopharmaceuticals that have been used to detect brain lesions include ^{206}Bi-nitrate ^{111}In-chloride, ^{67}Ga citrate and ^{131}I-labeled human serum albumin. The historical development of radionuclides concentrated by tumor is reviewed. (CH)

17607 MODIFIED RADIOIMMUNOASSAY FOR PERIPHERAL PLASMA ALDOSTERONE. Lijnen, P. J.; McCaa, R. E.; Fagard, R. H.; Amery, A. K. P. C. (Univ., Louvain, Belgium). FEBS (Fed. Eur. Biochem. Soc.) Lett.; 54: No. 1, 84-85(Jun 1975).

17608 VALIDITY OF THE RATES OF PRODUCTION AND UTILIZATION OF METABOLITES AS DETERMINED BY TRACER METHODS IN INTACT ANIMALS. Hetenyi, G. Jr.; Norwich, K. H. (Univ. of Ottawa). Fed. Proc.; 33: No. 7, 1841-1848(Jul 1974).

The evolution of tracer methods for measuring steady-state and nonsteady-state turnover rates is followed from the time of inception of such methods to the present. It was at first thought that the use of a tracer injection to measure steady-state turnover would result in a different value from that obtained by using a steady tracer infusion. By applying the principles of the theory of linear systems it was shown that the tracer injection and infusion methods will always yield the same value for the metabolic turnover rate provided that the data are properly analyzed. Two methods for measuring the nonsteady rate of appearance of production of a metabolite were reviewed. Each was shown to possess strengths and weaknesses, and a merging of the two methods was proposed. Errors tend to enter the calculations of turnover rates from three primary sources: scatter of measured data, evaluation of derivatives using such noisy data, and the recycling of labeled atoms. Methods proposed for removing these sources were reviewed. (auth)

17609 RELATIONSHIP OF ANTHROPOMETRIC MEASUREMENTS TO BODY FAT AS DETERMINED BY DENSITOMETRY ^{40}K, AND BODY WATER. Ward, G. M. (Colorado State Univ., Fort Collins); Krzywicki, H. J.; Rahman, D. P.; Quaas, R. L.; Nelson, R. A.; Consolazio, C. F. Am. J. Clin. Nutr.; 28: 162-169(Feb 1975).

A variety of anthropometric measurements were made on 223 male and 36 female military personnel for whom total body fat was estimated by density, ^{40}K counting, and D_2O dilution. Simple correlations with body fat estimates indicated that for the male population, waist, weight and buttocks circumferences were most highly correlated with fat estimate (r equals 0.70 to 0.85). In the female population skinfold thicknesses were the measurements most highly correlated with weight of body fat (r equals 0.66 to 0.87). Stepwise multiple regression analysis showed that five of the variables could account for 60 to 70 percent of the variation in fat in males and up to 90 percent in females. Correlations of measurements were higher with fat as estimated by density than with estimates derived from potassium-40 counting or D_2O dilution in males. (auth)

17610 MEASUREMENT OF RIGHT VENTRICULAR VOLUMES USING ^{131}I-MAA. Sekimoto, T.; Grover, R. F. (Univ. of Colorado, Denver). Am. Heart J.; 89: No. 2, 212-220(Feb 1975).

A method is presented for determining the right ventricular residual ratio, that is, the ratio of the end-systolic volume to the end-diastolic volume during each cardiac cycle. ^{131}I-MAA was injected as a bolus into the right ventricle, and the ratio of isotope remaining in the chamber during the succeeding cardiac cycles was determined with a collimated scintillation counter placed over the right ventricle. Since the counter detected the radioactivity from the entire right ventricular cavity, potential errors from incomplete mixing were minimized. The washout curve from the ventricle was distorted somewhat by the accumulation of isotope in intervening lung tissue. This distortion was eliminated by subtracting the build-up curve of radioactivity in the lung recorded simultaneously with a second scintillation counter positioned over the lateral chest wall. In 14 dogs anesthetized with chloralose, the right ventricular residual ratio was relatively constant at 40.4 +- 3.1 per cent. Duplicate measurements differed by less than 3 percent indicating the good reproducibility of the method. Right ventricular stroke volume was determined from cardiac output (dye dilution) and heart rate. With this and the simultaneously determined residual ratio (^{131}I-MAA), end-diastolic volume could be calculated. Stroke volume and stroke work were highly correlated with end-diastolic volume, in keeping with the Frank-Starling mechanism. (auth)

17611 INFLUENCE OF CHANGES IN PRECORDIAL COLLIMATION AND OF THE POINT OF INJECTION OF THE TRACER ON RADIOCARDIOGRAPHIC PARAMETERS. Bardi, U.; De Ponti, C. (Univ., Milan). Cardiol. Prat.; 25: No. 3, 267-274 (1974). (In Italian).

The influence on radiocardiographic variables of a peripheral injection of the tracer, and of a displacement of the precordial collimator to the right and to the left of the correct position, was studied in order to simplify the practical procedure (peripheral injection and omission of preliminary radioscopy). The peripheral injection of the tracer has determined a slightly wider dispersion of the data, without any statistical significant change. Displacement to the left of the collimator has resulted in a significantly reduced pulmonary blood volume. This change has been attributed mainly to an increase of the error in measurement of pulmonary circulation time. Displacement to the right of the collimator seems to be preferable, owing to the fact that, under these conditions, right and left radiocardiographic peaks are always well separated, permitting more precise measurements of mean pulmonary circulation time and, consequently, of pulmonary blood volume. (auth)

17612 RADIOACTIVE LABELLING OF BROME MOSAIC VIRUS. Bastin, M.; Kaesberg, P. (Wisconsin Univ., Madison). J. Gen. Virol.; 26: No. 3, 321-325(Mar 1975).

Brome mosaic virus (BMV) can be radioactively labeled by allowing virus synthesis to take place in barley leaves whose cut ends are placed in solutions of radioactive precursors of BMV. When barley plants are infected by inoculation of the first emerging leaf, the rate of incorporation of both ^{14}C-leucine and ^{32}P-orthophosphate into virus particles was found to be maximal in the second leaf, cut and labeled 4 to 5 days after inoculation. The rate of incorporation declined when the labeling or the cutting and labeling were delayed, even though assembly of particles still took place from pre-formed components. An exposure of 72 h to an appropriate amount of ^{32}P yielded highly radioactive BMV RNA for possible sequencing studies. A specific radioactivity (^{32}P) of the order of I mCi/mg RNA can be obtained readily. (auth)

17613 ELECTRORADIOIMMUNOASSAY (ERIA): A NEW TYPE OF DOUBLE ANTIBODY RADIOIMMUNOASSAY BASED ON ELECTROIMMUNODIFFUSION. Matzku, S.; Ludwig, R.; Rapp, W. (Univ. of Heidelberg). Clin. Chim. Acta; 54: No. 3, 317-323(20 Aug 1974).

A modified type of a sensitive and reliable double antibody radioimmunoassay is described. The modification consists of

the separation of free and bound antigen, which is achieved by electroimmunodiffusion in agarose gel. The second antibody is incorporated in a gel zone near the electrophoretic starting point. Electrophoretic separation is performed on specially devised Perspex plates in a routine immunoelectrophoresis unit within 2 h. The system was tested with α_1-acid glycoprotein in serum and in neutralized gastric juice. The least detectable concentration was 1 ng/ml. The precision coefficient was 0.02 to 0.035. (auth)

17614 INDICATIONS, POSSIBILITIES, AND LIMITATIONS OF HEMISPHERIC SCINTIGRAPHY IN THE DIAGNOSIS OF SUPRATENTORIAL INTRACRANEAL EXPANSIVE PROCESSES. Meduri, M.; Bonanno, N.; Cardia, E. (Univ., Messina, Italy). Acta Neurol. (Naples); 26: 572-585(1971). (In Italian).

Findings obtained by means of cerebral scintigraphy with MAAI-131 on 69 patients affected by intracranial tumors are considered. In order to estimate the value of scintigraphy with MAAI-131 a comparison of the results obtained with this method and those got with the use of EEGraphy and carotidography is made. The indications of clinical use and the possibilities to point-out regional cerebral blood flow derangements by this technique are emphasized. (auth)

17615 THERAPEUTIC AND DIAGNOSIS CRITERIA IN DEEP VENOUS THROMBOSIS OF THE LOWER EXTREMITIES. Pastor Mestre, A.; Martinez Perez, M.; Varela Irijoa, F.; Pintos Diaz, G. Angiologia (Barcelona); 26: No. 6, 345-348(1974). (In Spanish).

Doppler recording and fibrinogen labelled with ^{125}I were used for the diagnosis of deep venous thrombosis with excellent results. A comprehensive study of the different technics of venous thrombectomy is presented. (auth)

17616 DIAGNOSIS OF ELEVATED MOBILITY OF THE KIDNEYS IN CHILDREN BY MEANS OF RADIOISOTOPE RENOGRAPHY. Kovryzhkina, T. A.; Sibirko, A. V. (Central Scientific-Research Inst. of Roentgeno-Radiology, Leningrad). Med. Radiol.; 20: No. 4, 63-65(Apr 1975). (In Russian).

Based on studies on 33 patients, aged 4 to 15 years, showing hematuria and/or proteinuria, radioisotopic renography (^{131}I) is recommended for diagnosing increased kidney activity. A typical renogram is shown and discussed. (TTT)

17617 ^{67}Ga SCANNING IN THE STAGING OF HODGKIN'S DISEASE. Palumbo, R.; Tonato, M.; Martelli, M. F.; Corso, S.; Allegra, A.; Crino, L.; Grignani, F. (Univ. of Perugia, Italy). Acta Haematol.; 52: No. 5, 280-288(1974).

In 23 patients affected by untreated Hodgkin's disease, ^{67}Ga citrate scanning was performed as part of a clinical and pathological staging protocol. A good correlation (16/23) between ^{67}Ga scans and other diagnostic procedures was observed. In five cases there was a disagreement between clinical staging and ^{67}Ga data. Difficulties in interpreting ^{67}Ga scanning arised with the evaluation of mediastinum (five false positives) and abdominal involvement. ^{67}Ga scanning seems to be a useful but complementary procedure in the staging of Hodgkin's disease. (auth)

17618 BLOOD VOLUME DETERMINATION IN EXPERIMENTAL DOGS USING ALBUMIN LABELLED ^{125}I. Novak, K.; Kusak, I. (Vyzkummy Ustav Traumotologicky, Brno). Cesk. Fysiol.; 23: No. 2, 163-168(1974). (In Czech).

17619 RADIOACTIVE COMPOUND SUITABLE FOR X-RADIOGRAPHY OF THE SKELETON. (to Research Corp.). Netherlands Patent 7,315,928/A/. 21 Nov 1973. 13p. (In Dutch).

A radioactive compound suitable for x-radiography of the skeleton was found. Its chemical composition and preparation are described. Technetium-99m is the radioactive element and the compound may be one of several technetium-tin-organo-disphosphonic acids or their salts. The aqueous solution is suitable for intravenous injection. An extensive survey of tests on rabbits and a comparison with strontium-85 is given. (NL)

17620 INHIBITION OF THE PRIMARY INTERACTION BETWEEN ^{125}I-LABELED HUMAN HEMOGLOBIN AND RABBIT ANTI-HUMAN HEMOGLOBIN SERA: A SENSITIVE RADIOIMMUNOASSAY TECHNIQUE. Garver, F. A. (Medical Coll. of Georgia, Augusta); Talmage, D. W. J. Immunol. Methods; 7: No. 2, 271-282(Jun 1975).

A rapid and sensitive radioimmunoassay technique for human hemoglobin based on a modification of the Farr test is described. Since hemoglobin is soluble in ammonium sulfate whereas antibody is precipitated, the amount of free and antibody-bound radiolabeled human hemoglobin can be quantitatively measured after ammonium sulfate precipitation. Nanogram quantities of hemoglobin can be detected by the addition of unlabeled human hemoglobin to the antiserum before the labeled hemoglobin, thus establishing a competition reaction between labeled and unlabeled antigen for antibody. If sufficient quantities of unlabeled human hemoglobin are present, all of the antibody combining sites become saturated and the primary interaction between ^{125}I-labeled hemoglobin and antibody is completely inhibited. The method can be employed to discriminate various normal human hemoglobins, non-human primate hemoglobins, and sickle-cell hemoglobin (HbS). Other possible applications of the technique are discussed. (NL)

17621 IMPORTANCE OF LIVER SCANNING WITH ^{198}Au IN THE DIAGNOSIS OF CIRRHOTIC PROCESSES. Bazikola, P. V.; Shmakov, Yu. G. Vrach. Delo; No. 8, 87-89(Aug 1974). (In Russian).

Liver scanning with colloidal ^{198}Au is a valuable method for the diagnosis of chirrotic processes of the liver. It is possible to calculate the accumulation of the colloid in the spleen from the results of the liver scan. The results obtained with one patient are given as an example. (JSR)

17622 BONE SCINTIGRAPHY USING FLUORINE-18: A SEARCHING METHOD FOR BONE METASTASES OF MALIGNANT NEOPLASMS IN CHILDHOOD. Geiger, H. (Univ., Heidelberg). Monatsschr. Kinderheilkd.; 122: No. 7, 588(Jul 1974).

In 22 children with malignant neoplasms whole-body bone scintigraphy with ^{18}F proved a valuable supplement to the x-ray diagnosis of tumors affecting the skeleton system. (JSR)

17623 STUDY OF CERTAIN INDICATORS OF FUNCTIONAL STATE OF THE KIDNEYS AND HEART BY RADIOISOTOPE METHODS IN PATIENTS WITH CHRONIC PYELONEPHRITIS. Shul'tsev, G. P.; Buetsev, V. I.; Gavrilova, G. A.; Gerasimova, N. P. Sov. Med.; 37: 151(Mar 1974). (In Russian).

The simultaneous study of the functional state of the kidneys by measurement of ^{131}I-hippuran clearance and of the heart by radiocardiography was investigated in 88 patients with chronic pyelonephritis. Reduced ^{131}I-hippurance clearance was detected in all the patients and it was shown that this is directly dependent on the degree of impairment of the kidney function and the level of arterial pressure. (JSR)

17624 DIAGNOSIS OF KIDNEY INFARCTION USING RADIOISOTOPES. Dressler, J.; Hoer, G.; Heidenreich, P. (Technische Univ., Munich). Med. Klin. (Munich); 69: 1130-1137(1974). (In German).

In order to evaluate the value of radioisotopic techniques in the diagnosis of kidney infarction in comparison with clinical methods, two patients with confirmed infarctions were examined by all techniques. The etiology and pathology of infarctions and the clinical and radiological diagnostic methods are first reviewed. The results obtained with scanner color scintigraphy, perfusion-series scintigraphy, and ^{131}I-hippuran sequence scintigraphy are illustrated and show the comprehensive results obtained by the use of radioisotopes. (59 references) (JSR)

17625 COMBINED USE OF RADIOPERTECHNETATE AND ^{99m}Tc-POLYPHOSPHATE IN DISTINGUISHING CEREBRAL AND CALVARIAL LESIONS. Arzoumanian, A.; Rosenthall, L. (Montreal General Hospital). J. Can. Ass Radiol.; 25: No. 3, 178-183 (Sep 1974).

Thirty patients with intracerebral and/or calvarial lesions were imaged with ^{99m}Tc-pertechnetate ($^{99m}TcO_4$) and ^{99m}Tc-polyphosphate ($^{99m}TcPP$). Their lesions included cerebrovascular accidents, intracerebral neoplasms, metastatic disease to bone and post-craniotomy bone flaps. The aim of the study was to determine if $^{99m}TcO_4$ has a greater affinity for intracerebral disease than $^{99m}TcPP$, and if $^{99m}TcPP$ has a greater affinity for bone than intracranial abnormalities. Generally this was true, but in five out of thirty patients the expected differential accretion did not materialize. Of these five, four were cerebrovascular accidents. The combined study was most helpful in distinguishing recurrent brain tumor and metastatic tumor from post-craniotomy bone flap and calvarial metastases respectively. (auth)

17626 INDICATIONS FOR CESIUM-131 MYOCARDIAL SCINTISCANNING. Report of a Hundred Patients. Godeau, P. (Hopital Cochin, Paris); Leblanc, J.; Comet, M.; Herreman, G. Sem. Hop. Paris; 50: No. 17, 1153-1160(8 Apr 1974). (In French).

Myocardial scintiscanning using Cesium-131 is reported in a series of 100 patients over the years 1971 and 1972. Forty-nine patients had myocardial infarction, 7 coronary insufficiency without E. C. G. signs of infarction, 23 had left bundle branch block, 11 had primary myocardial disease, without obstruction, 7 had valvular heart disease, and 3 had pericarditis. The most favorable results were obtained in anterior infarction, whereas single plane scintiscanning is disappointing in posterior infarction which requires the use of two views. This examination seems interesting in primary myocardial disease where one can detect areas of fibrosis. Finally, it can help in the diagnosis of myocardial infarction in cases with left bundle branch block, which render difficult E. C. G. interpretation. (auth)

17627 POLYPEPTIDES OF MAMMALIAN ONCORNAVIRUSES. III. Localization of p15 and Reactivity with Natural Antibody. Ihle, J. N. (Oak Ridge National Lab., TN); Hanna, M. G. Jr.; Schaefer, W.; Hunsmann, G.; Bolognesi, D. P.; Hueper, G. Virology; 63: 60-67(1975).

Antiserum to p15 of Friend murine leukemia virus (FLV) reacted with intact MuLV's in radioimmunoprecipitation (RIP) assays. The antigen-antibody complexes formed by this reaction were isolated and shown to contain p15 after analysis by SDS polyacrylamide gel electrophoresis. Natural antibody in mice to MuLV reacted in a similar fashion with p15, but in addition, also with the virus glycoproteins (gp71, gp45). Biological studies indicated that gp71 rather than p15 is principally involved in the virus-neutralization reaction. These and other studies indicate that p15 is localized on the virus surface and is recognized by natural antibodies in mice to MuLV. (auth)

17628 RADIOLABELING OF PROTEINS AND VIRUSES IN VITRO BY ACETYLATION WITH RADIOACTIVE ACETIC ANHYDRIDE. Montelaro, R. C.; Rueckert, R. R. (Univ. of Wisconsin, Madison). J. Biol. Chem.: 250: No. 4, 1413-1421 (25 Feb 1975).

A convenient, rapid, and reproducible method for labeling proteins in vitro by acetylation with [^{3}H] or [^{14}C]acetic anhydride dissolved in small amounts of anhydrous dioxane is described. The reaction is carried out at neutral pH and does not require the use of detergents, water-immiscible organic solvents, oxidizing, or reducing agents. Thus undesirable solvent-induced alterations in protein structure and biological activity are minimized. A method for calculating the specific activity of the protein and the efficiency of acetylation at known concentrations of protein and acetic anhydride is presented. Radioacetylated proteins were shown to be suitable for use as molecular weight calibration standards and as protein markers in polyacrylamide gel electrophoresis, gel filtration, and enzyme studies. Acetic anhydride was used to label intact oncornaviruses, which consist of a complex ribonucleoprotein core within a lipid envelope. Some of the viral lipid and all of the viral proteins, including the internal ones, were labeled without detectable alterations in viral morphology or buoyant density. This result suggests that acetic anhydride, evidently by virtue of its small size and neutral charge, penetrates freely throughout the viral membrane and core structures. The reactivity of RNA with acetic anhydride was less than 1 percent that of protein under similar reaction conditions. (auth)

17629 RADIONUCLIDE BLOOD LEVELS DURING CISTERNOGRAPHY OF PATIENTS WITH NORMAL-PRESSURE HYDROCEPHALUS OR ALZHEIMER'S DISEASE. Mahaley, M. S. Jr.; Wilkinson, R. H. Jr.; Sivalingham, S.; Friedman, H.; Tyson, W.; Goodrich, J. K. (Duke Univ., Durham, NC). J. Neurosurg.: 41: No. 4, 471-480(Oct 1974).

Various diagnostic procedures were compared during investigations of 37 dementia patients undergoing differential study for normal-pressure hydrocephalus or Alzheimer's disease. A diminished radionuclide level in the blood, with abnormal cisternography and pneumoencephalography, provided the most valuable diagnostic evidence of normal-pressure hydrocephalus. (auth)

17630 LIMITATIONS OF RADIONUCLIDE FLOW STUDIES IN BILATERAL CAROTID THROMBOSIS. Messert, B.; Tyson, I. B.; Barron, S. A. (Veterans Administration Hospital, Madison, WI). Stroke.: 6: No. 1, 67-71(1975).

Radionuclide angiography as a noninvasive procedure has become an important tool in the evaluation of cerebrovascular diseases. Determinations of arm-to-brain circulation times complemented by the transit times of the radionuclide bolus through the brain afford insight into the functional status of the vascular system of the brain. Delays in perfusion, asymmetries in appearance, and washout of the radionuclide material can be correlated with disease entities. However, as with many procedures elevated to the status of a screening test, the possibility of false-positive and false-negative results exists. Two cases of bilateral carotid occlusion are presented, showing normal or only delayed, fairly symmetrical brain perfusion. The appearance of the radionuclide flow in the neck in AP and lateral views gave no suggestion of the involved deficits. Even multiple-projection imaging might fail to demonstrate major vascular obstructions. However, attentive study of these projections might yield interesting evidence of unexpected collateral flow systems. (auth)

17631 DISTRIBUTIONAL CHANGES OF ^{32}P-LABELED ACID-SOLUBLE PHOSPHATES AND PHOSPHOLIPIDS AMONG SUBCELLULAR FRACTIONS DURING EARLY VERTEBRATE EMBRYONIC DEVELOPMENT. Pechen, A. M.; Bonici, I. C.; Bazan, N. G. (Universidad Nacional del Sur, Bahia Blanca, Argentina). Biochim. Biophys. Acta; 372: No. 2, 388-399(5 Dec 1974).

Early developing embryos of the toad Bufo arenarum Hensel were employed to study the content and in vivo labelling with ^{32}P of the acid-soluble phosphates and phospholipids at the subcellular level. The radionuclide was administered to the female toad along with the pituitary extract used to induce the ovulation. Most of the total phospholipids (68%) and proteins (84%) are confined to the yolk platelet fractions. Up to the heart beat stage (130 h of development) there are no significant changes detectable in protein and phospholipid content. The total P content in trichloroacetic acid-soluble fraction was distributed mainly between postmitochondrial supernatant (58%) and yolk platelet fraction (37%) in the unfertilized oocyte. As development proceeds an increase was observed in the former and a decrease in the latter. The acid-soluble phosphates in the mitochondrial fraction only amount to 4% of the total embryo throughout the examined stages. The unfertilized oocyte contains about 98% of acid-soluble phosphates labelled with ^{32}P in the postmitochondrial supernatant and as development proceeds a striking decrease was found to occur while the radioactivity in the acid-soluble phosphates of mitochondrial and yolk platelet fractions increases significantly during the studied stages. About 11.5% of the lost radioactivity from the acid-soluble phosphates was found to be used to label the phospholipids. (NL)

17632 STUDY ON CELL PROLIFERATION IN EPITHELIUM OF THE UTERINE CERVIX BY AUTORADIOGRAPHY WITH ^{3}H-THYMIDINE. Takeoka, T. (Nippon Medical School, Tokyo). Nippon Ika Daigaku Zasshi; 41: No. 4, 175-184(Aug 1974). (In Japanese).

In order to study the process of carcinogenesis in the cervix, microautoradiography with ^{3}H-thymidine was performed in the normal pavement epithelium, normal cylindrical epithelium, and lesions of reserve cells, squamatization, dysplasia, carcinoma in situ, and invasive carcinoma, and the localization of labelled cells and label-index were examined. As to the pavement epithelium, the radioactivity in the normal cells mostly localized within the parabasal layer, but that in the lesion of reserve cell proliferation, dysplasia, and carcinoma in situ ranged from the basal layer to the surficial layer. As the lesions advanced from reserve cell hyperplasia to squamatization, labelled cells became more frequently shown in the parabasal layer, and in some cases of invasive carcinoma, uptake of radioactivity was also observed in the keratinyzed cells. (JA)

17633 FACTORS AFFECTING INCORPORATION OF [^{14}C] LEUCINE INTO ALBUMIN AND TRANSFERRIN BY THE LIVER IN THE POSTNATAL RAT. Yeoh, G. C. T.; Morgan, E. H. (Western Australian Univ., Nedlands). Biochim. Biophys. Acta; 378: No. 1, 133-142(6 Jan 1975).

The mechanisms responsible for the increase in incorporation of radioactive amino acids into albumin, transferrin, and total soluble liver protein which occurs in the immediate postnatal period in the rat were investigated in rats delivered surgically in the last two days of gestation. The in vivo incorporation of ^{14}C-leucine into the proteins in the liver was low at birth, but increased rapidly during the first half hour after delivery, and then more gradually during the subsequent 4.5 h. Neonatal adrenalectomy had no effect on this pattern of results. Intraperitoneal administration of an amino acid supplement had little effect on ^{14}C-leucine incorporation immediately after birth, but increased incorporation at 0.5 h and eliminated the second phase of rising values between 0.5 and 5 h. The in vitro incorporation of ^{14}C into albumin, transferrin, and total protein by slices of the liver from animals immediately after delivery was as great as with slices from animals 5 h after delivery. Conclusion: the increase in synthesis of proteins in the first 0.5 h after the delivery is probably due to an increase of the supply of metabolic energy due to improved oxygenation; and the slower increase in protein synthesis between 0.5 and 5 h results from an improved supply of amino acids to liver cells. It is unlikely that changes in the secretion of adrenal hormones are involved. (NL)

17634 EFFECT OF THE EXOTOXIN OF BACILLUS THURINGIENSIS ON THE BIOSYNTHESIS AND MATURATION OF MOUSE LIVER NUCLEAR RNA. Mackedonski, V. V. (Inst. of Biochemistry, Sofia). Biochim. Biophys. Acta; 390: No. 3, 319-326(May 1975).

The effect of the exotoxin of Bacillus thuringiensis on the in vivo incorporation of (^{14}C) orotic acid into mouse liver nuclear rRNA and low molecular weight RNA was studied. The following results were obtained. The exotoxin does not inhibit the synthesis of 45 S pre-rRNA, but causes a breakdown of these molecules. The exotoxin inhibits the conversion of 38 S pre-rRNA into 32 S and 21 S. The exotoxin inhibits the labelling of nuclear 5 S RNA, whereas the labelling of 4.6 S pre-tRNA is not affected. It is

suggested that 5 S RNA may control the processing of 45 S pre-rRNA. (NL)

17635 CLINICAL EVALUATION OF ^{111}IN-BLEOMYCIN IN THE SCINTILLOGRAPHY OF TUMORS. Bennett, L. R. (Univ. of California, Los Angeles). Gac. Med. Mex.; 107: 174-178(Feb 1974). (In Spanish).

The use of ^{111}In-bleomycin in the detection of malignant tumors was clinically evaluated on 102 patients with various types of confirmed or suspected tumors. The ^{111}In-bleomycin was injected intravenously at a dose of 75 μCi/kg body weight 48 hours before scintiscanning. A good correlation was obtained between the scan data and the extent of the tumor in 71% of the cases; in 10% there was no correlation; and in 19% there was an abnormal accumulation in non-neoplastic lesions. (JSR)

17636 SELECTIVE PANCREATIC SCINTISCANNING IN THE DIAGNOSIS OF PANCREATIC DISEASES. Gulizzi, F.; Marenco, G.; Cugudda, E.; Foscolo, P. (Santa Corona Hospital, Pietra Ligure, Italy). Minerva Med.; 66: No. 9, 424-431(7 Feb 1975).

From 13th congress of Italian Society of Biology and Nuclear Medicine; Pisa, Italy (Nov 1972).

Pancreas scintiscanning using electronic image subtraction proved useful in the diagnosis of pancreatic disease. Confirmation of this was found on comparison of the scintiscan picture and the surgical picture on gross inspection in 50 cases. Findings indicative of pancreatitis cysts and tumours are illustrated, together with those given by scintiscanning of pancreas alterations occurring in the course of diseases affecting nearby organs. (auth)

17637 RADIOIMMUNOASSAY OF CHOLECYSTOKININ-PANCREOZYMIN. Harvey, R. F.; Dowsett, L.; Hartog, M.; Read, A. E. (Univ. of Bristol, Eng.). Gut; 15: No. 9, 690-699(Sep 1974).

A sensitive and specific radioimmunoassay for cholecystokinin-pancreozymin (CCK-PZ) has been developed, using rabbit antisera to crude porcine hormone. Highly purified porcine CCK-PZ, labelled with ^{131}I, and repurified by column chromatography on Sephadex G15, was used as tracer. Separation of free from antibody-bound labelled CCK-PZ was carried out using charcoal, ion-exchange resin, or double antibody procedure. Non-specific interference with the assay system by serum factors was abolished (as judged by in-vitro and in-vivo recovery studies) by boiling and diluting the serum samples before assay. Ninety-nine per cent pure porcine CCK-PZ (standard), commercial CCK-PZ preparations, caerulein, the C-terminal 8- and 12-amino acid fragments of the CCK-PZ molecule, and endogenous human CCK-PZ all cross reacted in the assay system and showed parallel inhibition curves. No significant cross reaction was found with gastrin, secretin, glucagon, or insulin. The sensitivity of the assay is approximately 5 pg per ml of test solution, which proved adequate for measuring physiological levels of CCK-PZ in peripheral blood in man. The mean immunoreactive CCK-PZ concentration in 50 fasting normal subjects was 60.4 pg per ml. The distribution of individual values was skewed, however, so that the median was much lower (30 pg per ml). Older subjects had fasting levels of CCK-PZ than were found in young adults. (auth)

17638 ENHANCED RATE OF ^{14}C-SOLUTE RELEASE TO THE FREE SPACE BY THE PHLOEM OF VICIA FABA STEMS PARASITIZED BY CUSCUTA. Wolswinkel, P. (Univ., Utrecht). Acta Bot. Neerl.; 23: No. 2, 177-188(Apr 1974).

By washing out ^{14}C-labeled assimilates from the free space of stem segments of Vicia faba L., considerably more label could be removed from a stem parasitised by Cuscuta species than from a normal one. This could mean that the moving of assimilates from the host phloem to the parasite at least partly occurs through the apoplast. The assumed unloading of the host phloem is apparently under metabolic control since it appeared to be inhibited at 0°C and after addition of dinitrophenol. (auth)

17639 BIOLOGICAL ACTIVITY OF ^{125}I-LABELED GLOBIN mRNA IN AN EHRLICH ASCITES CELL-FREE SYSTEM. Knoechel, W. (Univ., Freie, Ger.). Mol. Biol. Rep.; 1: No. 6, 311-320(Mar 1974).

Globin mRNA was isolated from avian erythroblasts and labelled with iodine-125 to a specific activity of 4.5×10^6 dmp μg^{-1} mRNA. The labeling procedure was modified as compared to common techniques in order to protect the mRNA against degradation. When this RNA is translated in an Ehrlich ascites cell-free system, globin chains are synthesized as is demonstrated by the analysis of the in vitro synthesized products. The biological activity of ^{125}I labeled mRNA has proven to be 30% of that of unlabeled mRNA. (NL)

17640 DEVELOPMENT OF A RADIOIMMUNOASSAY FOR MORPHINE HAVING MINIMAL CROSS-REACTIVITY WITH CODEINE. Morris, B. A.; Robinson, J. D.; Piall, E.; Aherne, G. W.; Marks, V. (Univ. of Surrey, Guildford, Eng.). J. Endocrinol.; 64: No. 1, 6P-7P(Jan 1975).

The development of a radioimmunoassay for morphine for use in clinical and pharmacological studies is reported. As it was necessary to produce an antiserum that would not react with either its principal metabolite, morphine-3-glucuronide, or with codeine, it was decided to conjugate morphine to the carrier through its heterocyclic nitrogen. On account of the low reactivity of the N-methyl group in morphine, nor-morphine was chosen as the hapten for conjugation to BSA. The cross-reactivity with heroin was 87.5% while that of codeine was only 5.5%. The method used to increase the low titre of the antiserum is described. Using the N-succinylnormorphine-BSA conjugate produced injected into rats, antibodies to morphine, showing no cross-reactivity with codeine, were produced in four out of the six animals immunized. (UK)

17641 RADIOIMMUNOASSAYS OF PROSTAGLANDIN $F_{2\alpha}$ AND PROSTAGLANDIN $F_{2\alpha}$-MAIN URINARY METABOLITE WITH PROSTAGLANDIN-^{125}I-TYROSINE METHYLESTER AMIDE. Ohki, S. (Ono Pharmaceutical Co., Ltd., Sakurai, Japan); Hanyu, T.; Imaki, K.; Nakazawa, N.; Hirata, F. Basic Res. Cardiol.; 6: No. 2, 137-148(25 Apr 1974).

Radioimmunoassays for measuring prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) and 5α, 7α-dihydroxy-11-keto tetranorprosta-1, 16-dioic acid, $PGF_{2\alpha}$-main urinary metabolite($PGF_{2\alpha}$-MUM), with ^{125}I-tyrosine methylester amide (TMA) of $PGF_{2\alpha}$ and $PGF_{2\alpha}$-MUM were developed. Antibody to $PGF_{2\alpha}$ was produced in rabbits immunized with conjugates of $PGF_{2\alpha}$ coupled to bovine serum albumin. Antibody to $PGF_{2\alpha}$-MUM was also produced in rabbits immunized with conjugates of $PGF_{2\alpha}$-MUM coupled to bovine serum albumin. The $PGF_{2\alpha}$-^{125}I-TMA had an affinity to antiserum to $PGF_{2\alpha}$ and $PGF_{2\alpha}$-MUM-^{125}I-TMA also responded to antiserum to $PGF_{2\alpha}$-MUM. (auth)

17642 EXAMINATION OF THE THORAX WITH RADIOISOTOPES. Zimbron-Levi, A. Gac. Med. Mex.; 107: 58-164 (Feb 1974). (In Spanish).

A cursory review is given of the routine diagnostic procedures for radioisotopic examination of the thorax. The use of ^{133}Xe for perfusion and ventilation sequence gammagraphy of the lungs is cited. Other isotopes in routine use include ^{75}Se, ^{67}Ga, ^{131}I, ^{123}I, ^{18}F, and ^{99m}Tc. (JSR)

17643 QUANTITATIVE DETERMINATION OF PROSTAGLANDINS IN HUMAN GASTRIC JUICE BY RADIOIMMUNOASSAY. Peskar, B. M. (Univ., Vienna); Holland, A.; Peskar, B. A. Clin. Chim. Acta; 55: No. 1, 21-27(30 Aug 1974).

Prostaglandins in human gastric juice and human saliva were determined by radioimmunoassay after extraction and chromatography on silicic acid columns. Basal levels in gastric juice were found to be 443.8 ± 49.0 pg/ml prostaglandin E_2 and 153.7 ± 23.6 pg/ml prostaglandin A_2. Prostaglandin $F_{2\alpha}$ was below 50 pg/ml in most cases. The prostaglandin A_2 found seems to be secreted as prostaglandin E_2 which is dehydrated after secretion at the low pH of gastric juice. Some of the prostaglandin A_2 might also come from saliva. Pentagastrin stimulation of gastric secretion did not significantly change the concentrations of prostaglandins in gastric juice, but tended to increase the total output of prostaglandins concomitantly with the increase in volume of gastric secretion. (auth)

17644 SELECTIVE UPTAKE OF ^{3}H-LEUCINE BY PROJECTION NEURONS OF THE CAT AUDITORY CORTEX. Sousa-Pinto, A.; Reis, F. F. (Univ. of Oporto, Portugal). Brain Res.; 85: No. 2, 331-336(28 Feb 1975).

From international symposium on the use of anonal transport for studies of neuronal connectivity; Gwatt-Thun, Switzerland (28 Feb 1975).

17645 DEVELOPMENT OF RADIOIMMUNOASSAYS FOR FIBRINOGEN DEGRADATION PRODUCTS: FRAGMENTS D AND E. Gordon, Y. B.; Martin, M. J.; Landon, J.; Chard, T. (Saint Bartholomew's Hospital, London). Br. J. Haematol.; 29: No. 1,109-119(Jan 1975).

Fibrinogen degradation products, fragment D (FgD) and fragment E (FgE) were measured in human serum by specific radioimmunoassays. In addition, the appearance of a neoantigenic determinant on FgD, revealed when fibrinogen is degraded by plasmin was utilized to develop a specific radioimmunoassay for FgD in plasma (FgD_{neo}). The reagents and conditions used in each assay are described in detail. The mean specific activity was 144 μCi/μg for ^{125}I-labeled FgE and 82 μCi/μg for ^{125}I-labeled FgD. Separation of antibody bound and free antigen was achieved using second antibody. The detection limits of the FgE, FgD, and FgD_{neo} assays were 0.8, 1.0, and 6.2 ng/ml respectively. The specificity of each assay with respect to fibrinogen and its deg-

radation fragments has been assessed. Fibrinogen and fragment X cross-reacted markedly in both the FgE and FgD assays, whereas the cross-reaction of fibrinogen was abolished in the FgD_{neo} assay, while the cross-reaction of fragment X was 10%, indicating gradual emergence of the neoantigenic site during digestion of fibrinogen. The sensitivity, precision, and specificity of the radioimmunoassay systems described have major advantages over the existing procedures for the measurement of fibrinogen degradation products. (auth)

17646 INFLUENCE OF INFLAMMATION ON THE ^{125}I-FIBRINOGEN UPTAKE TEST IN EXPERIMENTAL THROMBOSIS. Hladovec, J.; Prerovsky, I.; Roztocil, K. (IKEM, Prague). Angiologica; 10: 93-100(1973).

The ^{125}I-fibrinogen uptake test was used in rabbits after the production of thrombosis in the marginal ear vein. The uptake was very similar with thrombosis produced by irritants, thrombin as well as with inflammation without thrombosis. The ^{131}I-albumin accumulated under these conditions to the same extent or even more than ^{125}I-fibrinogen. The local increase of permeability seemed to represent the most important factor in the uptake of both ^{125}I-fibrinogen and ^{131}I-albumin. (auth)

17647 SCINTIGRAPHY IN THE DIAGNOSIS OF PANCREATIC DISEASES. Bekier, A.; Berkovits, G. (Kantonsspital, St. Gallen, Switzerland). Schweiz. Med. Wochenschr.; 104: No. 51, 1914-1917(21 Dec 1974). (In German).

A report is given on 295 pancreatic scans performed in the period 1966 to 1973. The result of the scan could be compared with surgical or autopsy findings in 62 cases. Forty three scans were of diagnostic utility, while 19 were negative. The degree of concordance between the 43 diagnostically usable scans and the findings was 81.4%. Scanning did not prove its worth in tumor diagnosis, since all the pancreatic malignancies diagnosed by scanning were already inoperable. (auth)

17648 MEASUREMENT OF ORGAN IMAGE AND FUNCTION BY MEANS OF RADIOISOTOPE SCINTIGRAPHY. Iinuma, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Keisoku To Seigyo; 13: No. 5, 403-413(May 1974). (In Japanese).

Imaging of human organs by means of radioisotopes is widely used in diagnosis, and is called RI imaging or scintigraphy. Essentially, it requires three dimensional distribution, but many systems employ the images projected on a two dimensional plane. Two dimensional RI imaging system includes two types, scanning system and fixed system. Three dimensional systems are divided into three kinds: (1) tomographic imaging systems, (2) transverse imaging systems, and (3) positron imaging systems. Machine-assisted diagnosis requires physician's reading, and the automated diagnosis means that data processers perform final decision without physician's intervention. The data processing involves the techniques such as improvement of image quality, contrasting digital images according to counts for ease of observation, and closely displaying the specific portion to be emphasized. Since the upgrading of RI imaging system is accompanied by the increase of cost, the system must be evaluated by both quantity and quality of diagnostic information obtained and the cost. (JA)

17649 STUDIES ON A COMPARISON OF THE COMPETITIVE PROTEIN BINDING ASSAY AND RADIOIMMUNOASSAY FOR PLASMA PROGESTERONE. Miyakawa, I.; Matsuo, I.; Ikeda, I.; Mori, N. (Kumamoto Univ. (Japan). School of Medicine). Nippon Sanka Fujinka Gakkai Zasshi; 26: No. 12, 1347-1354(Dec 1974). (In Japanese).

The measurements of plasma progesterone with reference to competitive protein binding assay (CPBA) and radioimmunoassay (RIA) were compared to each other and discussed for the purpose of their clinical use. The sensitivity of RIA using antiserum obtained from the rabbits immunized by progesterone-3-BSA was superior to that of CPBA using PBP obtained from the serum of pregnant guinea pigs. As to CPBA, results of incubation were remarkably affected by temperature, showing that the binding rate was optimal at 4°C, and could not be determined at 37°C and 45°C. On the contrary, RIA revealed no effect of temperature between 4°C to 45°C. Concerning incubation time, RIA was possible to incubate at most for 30 minutes. Progesterone binding protein (PBP) revealed the cross reaction with intrinsic steroid hormones, such as desoxycorticosterone (DOC), 20α-dihydroprogesterone, pregnenolone, testosterone, and 17α-OH-progesterone, but in RIA, there were no strong cross reaction except for pregnenolone. RIA had superiority over all the method for measuring plasma progesterone, however, CPBA was convenient on the point that PBP could be obtained from pregnant guinea pigs. The further clinical application of both methods was expected. (JA)

17650 ABSORPTION, DISTRIBUTION, EXCRETION, AND METABOLISM OF CARBAZILQUINONE, A NEW ANTI-TUMOR AGENT, IN MICE. Shindo, H.; Nambu, K.; Nakajima, E.; Kawai, K. (Sankyo Co. Ltd., Tokyo (Japan). Central Research Lab.). Yakugaku Zasshi; 94: No. 11, 1393-1403(Nov 1974). (In Japanese).

The absorption, distribution, excretion, and biotransformation of carbazilquinone [2,5-bis(1-aziridinyl)-3-(2-carbamoyloxy-1-methoxyethyl)-6-methyl-1,4-benzoquinone], a new antitumor agent, in mice were investigated after oral and intravenous administration of the drug labeled with ^{14}C at the aziridinyl moiety. After intravenous and oral administration about 50% of the dose was recovered in the urine during the first 24 hr, and about 25% and 40% in the feces, respectively. Whole-body autoradiography and radioassay revealed that a very high uptake of radioactivity occurs mainly in the excretory organs such as the liver, gall bladder, intestine, kidney, and urinary bladder, and a high uptake in the lung, salivary gland, and hypophysis. Carbazilquinone was found to be excreted in the urine as more than 15 kinds of metabolites, most of which are non-extractable with ethyl acetate and are thus metabolites. Two metabolites were identified as unchanged carbazilquinone and a compound in which one of the two aziridine rings is opened to form hydroxyethylamino group. After intravenous administration, the blood level of carbazilquinone declined rapidly with an approximate half-life of 13.5 min. (auth)

17651 STUDIES ON ASPERGILLUS PROTEINASE, 8. Intestinal Absorption of the Semialkaline Proteinase from Aspergillus Melleus. Yamaguchi, K.; Moriwaki, C. (Science Univ. of Tokyo (Japan)); Sugiura, M. Yakugaku Zasshi; 94: No. 11, 1404-1407 (Nov 1974). (In Japanese).

Intestinal absorption of the semi-alkaline proteinase (SAP) from Aspergillus melleus was examined in the rat whose mesenteric vascular system was perfused in situ with Krebs–Ringer bicarbonate buffer containing 6% dextran. When the rat was given 0.25 to 4 mg of SAP and ^{125}I-labeled SAP in each of the ligated jejunum, the perfusate contained nondiffusible ^{125}I-binding macromolecule(s), and the amount recovered during 60 min corresponded to 0.8–1.7% of ^{125}I-SAP administered. Immunochemical analysis of the perfusate obtained from rats given 10 mg of SAP revealed a precipitin band against the anti-SAP rabbit serum on an immunodiffusion plate. These results suggest that SAP may be transmitted into the mesenteric vascular system across the intestinal wall, retaining its immunoreactivity. (auth)

17652 INVESTIGATION ON THE DETERMINATION METHOD OF TOTAL IRON BINDING CAPACITY USING RADIOACTIVE IRON. A Method Using Res-O-Mat Fe Kit (TIBC). Okazaki, T.; Okada, H.; Kato, T.; Yanagida, M.; Miyamura, S. (Mie Prefectural Univ., Tsu (Japan). School of Medicine). Rinsho Ketsueki; 15: No. 12, 1303-1308(Dec 1974). (In Japanese).

Determination of Total Iron Binding Capacity (TIBC) using Res-O-Mat Fe kit (TIBC) offered by Daiichi Radioisotope Laboratories, Ltd. was investigated. This kit method is to determine the total iron binding capacity of transferrin by counting the radioactivity of ^{59}Fe which was bound to transferrin after removing the serum iron from the transferrin by adding 0.6% citric acid. About 95% of unbounded ^{59}Fe was adsorbed by Resin Strip (Amberlite IRA 400) after 90 minutes incubation, and this method is very simple and sufficient for clinical use. TIBC value determined by this method well agreed with the value of (UIBC + SI) determined by the other method. Denaturation of transferrin due to change of serum pH was investigated by Ouchterlony's method and immunoelectrophoresis, but no change of transferrin was observed. Tf value determined by immunodiffusion method showed fairly good correlation with TIBC value. SI value determined by colorimetry also well agreed with the value of (TIBC-UIBC). This kit method is found to be simple and useful in clinical application. (auth)

17653 CLINICAL APPLICATIONS OF THE RADIOALLERGOSORBENT TEST (RAST) IN SEASONAL ALLERGIC RHINITIS. Kataura, A.; Kimura, T. (Sapporo Medical Coll. (Japan)). Nihon Univ. J. Med.; 16: No. 3, 221-228(Sep 1974).

Investigation of the action of specific IgE antibodies against allergens in the blood during attacks of seasonal allergic rhinitis using the Radioallergosorbent Test (RAST Phadebas), showed an agreement rate of 76.3% with the skin provocation test with pollen allergens and a rate of 62.2% with the nasal provocation test, both of which are considered to be fairly high. Thus the clinical significance of RAST for the in vitro diagnosis of seasonal allergic rhinitis was recognized. By using jointly with the skin reaction, nasal provocation, and nasal smear eosinophil counts the RAST has given dramatic progress in clinical treatment of nasal allergies, and it is expected to be employed clinically to a further extent in the future. (auth)

17654 SUBUNITS OF HUMAN CHORIONIC GONADOTROPIN AND THEIR RADIOIMMUNOASSAYS. Ashitaka, Y.; Nishimura, R.; Endoh, Y.; Tojo, S. (Kobe Univ. (Japan). School of Medicine). Endocrinol. Jap.; 21: No. 5, 429-435(Oct 1974).

Human chorionic gonadotropin (HCG) subunits were isolated from HCG by chromatography on DEAE Sephadex A-50. Iodination of HCG by the enzymatic iodination method resulted in a preparation labeled almost exclusively on the α-subunits of HCG, and masking of tyrosine residues in the β-portion when bound to the α-portion of HCG molecule was interpreted. Antisera of the HCG subunits enabled radioimmunoassay of those subunits. Sera obtained from pregnant women were radioimmunoassayed for HCG, HCG-α and HCG-β in respective homologous radioimmunoassay systems. Real amounts of those hormones were calculated by subtracting the interference of non-homologous hormones in the homologous assays. Absolute amounts of HCG reached its peak (several microgrammes per ml) in the first trimester, then decreased and continued the values less than 1.5 microgrammes per ml thereafter. Surprisingly the amounts of HCG-α in sera increased in the former half, reaching several hundreds nanogrammes per ml in the latter half of pregnancy, while the amounts of HCG-β were ranged in less than 100 nanogrammes per ml. The significance of immunoreactive HCG-α during pregnancy was speculated. (auth)

17655 AUTORADIOGRAPHIC STUDY ON THE DISTRIBUTION OF CYCLOCYTIDINE IN MICE. Hoshi, A.; Iigo, M.; Kuretani, K. (National Cancer Center, Tokyo (Japan). Research Inst.); Kanai, T.; Ichino, M. Chem. Pharm. Bull. (Tokyo); 22: No. 10, 2311-2317(Oct 1974).

The distribution of cyclocytidine was investigated by means of whole-body autoradiographic technique following intravenous injection in mice. Significant difference was found in the distribution pattern of radioactivity between cyclocytidine and other cytidine analogues such as aracytidine. Distribution of cyclocytidine was more localized in some organs than that of aracytidine, and was analogous to that of cytidine and not deoxycytidine. Cyclocytidine and aracytidine disappeared almost completely from the body within 24 hr. These two compounds were scarcely incorporated in acid-insoluble components in tissues within 10 min, whereas cytidine and deoxycytidine was rapidly incorporated into nucleic acids and the latter two compounds retained over 24 hr. (auth)

17656 METABOLISM OF QUATERNARY AMMONIUM COMPOUNDS, 2. Microautoradiographic Studies on the Effect of CCl_4 on the Intralobular Distribution of Tritiated BTTB in Mice Liver. Matsumoto, Y.; Takebe, Y.; Suga, T.; Niinobe, S. (Tokyo Coll. of Pharmacy (Japan)). Chem. Pharm. Bull. (Tokyo); 22: No. 12, 2861-2865(Dec 1974).

The intralobular distribution of ^{3}H-labeled p-biphenylmethyl-(dl-trophyl-α-tropinium)-bromide (^{3}H-BTTB) and the affect of CCl_4-injury on its distribution were studied in mice mainly by means of microautoradiographic technique. It was established that ^{3}H-BTTB was mostly concentrated in the cytoplasm of hepatic parenchymal cells and that his drug distributed homogeneously over the whole intralobular area. In CCl_4-treated mice, uptake of ^{3}H-BTTB was markedly decreased in the liver and, on the other hand, was apparently increased in the kidney. In addition, the decrease in the uptake of this drug by CCl_4-treated liver occurred widely within the liver lobules and more significant decreases were found especially in the central zones of the lobule. During the course of preparation of microautoradiographic tissue sections, the degree of released radioactivity in CCl_4-treated livers was inclined to increase over that of the controls. (auth)

17657 A STUDY OF GAMMA CAMERA IMAGING WITH SELENIUM-75. Matsumoto, M.; Ishigami, K. (Kumamoto Univ. (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 34: No. 8, 590-598(Aug 1974). (In Japanese).

Although ^{75}Se-selenomethionine is mostly used for pancreas scintigraphy, this radioactive substance has a relatively longer physical half-life, more highly absorbed dose compared to other radioactive agents when clinically used, and in addition is too expensive now. Selenium-75 emits γ rays of 401, 280, 265, 136, and 121 keV energy; both 280 and 265 keV, however, are commonly used for imaging of it. The studies were carried out in order to investigate the practical usefulness of other γ-rays based on the increase in the counting efficiency at the time of ^{75}Se imaging, and also on the decrease of administered dose: effect of scattered radiation, uniformity of sensitivity, spatial resolution, and so forth. The conclusions are as follows: γ rays of both 136 and 121 keV were satisfactorily available for the imaging of ^{75}Se by means of the careful and exact setting up of the energy ranges. And counting efficiency was above twice when γ rays of both 280 and 265 keV were measured simultaneously with these of 136 and 121 keV. It was found that about 100 MCi which is even less than conventional dose, therefore, is quite available for the clinical use. (auth)

17658 MULTILEVEL ANALYSIS OF ISOCOUNT SCINTISCANNED DATA. Ikebe, J.; Nawa, A.; Tada, H. (Tokyo Inst. of Tech. (Japan)); Jimbo, M. Bull. Tokyo Inst. Technol. (Engl. Ed.); No. 119, 15-24(Sep 1973).

The isocount scintiscanning yields a constant relative deviation of the collected data over all the observed plane. This fact enables the multilevel analysis of the scanned organ, which consists in presenting a sequence of silhouettes on a television screen. The silhouette corresponds to the area with count rate higher than a given slice level and its form changes when this level is gradually varied. This kind of dynamic movement of the picture facilitates the feature extraction, for human sensors are very keen to such variations, and even a not so experienced physician can make the analysis based on this technique. The resulting sequence of silhouettes of this analysis is named sequential scintigram. Two other displays were also tried for the isocount scintiscanning, as preliminary steps toward the multilevel analysis; they were the monochromatic photoscintigram and the color television display. Both present advantages and disadvantages but none seems to be competitive with the sequential scintigram. The detailed mechanism of each display is presented as a process that culminates in the multilevel analysis and many illustrative examples of brain scanning are also shown. (auth)

17659 SCINTIGRAM DISPLAY SYSTEM WITH TWO-DIMENSIONAL INTERPOLATION. Nawa, O. A.; Kuroda, Y.; Ikebe, J. (Tokyo Inst. of Tech. (Japan)). Bull. Tokyo Inst. Technol. (Engl. Ed.); No. 123, 57-65(Mar 1974).

The reduction of scanning time, improvement of picture quality, and elimination of unstable factors involved in the film developing process are achieved through a new scanning mode in association with a display system that evaluates the count rate of each picture element by means of two-dimensional interpolation. The scanning time necessary to compose a view of a brain is reduced from about 35 minutes using the isocount method to about 10 minutes by using interpolation, without any loss of picture quality. By simply turning a switch, multilevel analysis is also available with the same display system. (auth)

17660 A STUDY ON THE RADIOIMMUNOASSAY OF SERUM TRIIODOTHYRONINE. Ban, Y.; Inoue, T.; Kojima, T.; Nagashima, N.; Watanabe, Y. (Showa Univ., Tokyo (Japan). School of Medicine). Kaku Igaku; 11: No. 4, 479-487(Aug 1974). (In Japanese).

Preparing antibody for triiodothyronine (T_3) by ourselves, the serum T_3 concentration was determined by radioimmunoassay. Twenty euthyroid normal control volunteers, twenty hyperthyroid patients, seven hypothyroid patients, three patients with subacute thyroiditis, and one patient with TBG deficiency were employed in this study. The assay procedure was similar to the conventional method, except for using T_3 free serum treated with 8-anilino-1-naphthalene sulfonic acid (ANS) and charcoal. The precision and the reproducibility of this assay system were quite excellent, having a coefficient of variation of 4.9% for the former, and 8.6% for the latter. The rate of recovery was 106%. The concentration of serum T_3 was 127 ± 26 (mean ± S.D.) ng/100ml for euthyroid normal volunteers, 575 ± 262 ng/100ml for hyperthyroid patients and 54 ± 22 ng/100ml for hypothyroid patients. Our euthyroid average value was well comparable to those reported by Sakurada et al., Hachiya, and Mitsuma. In three patients with subacute thyroiditis there were 120, 126, and 147 ng/100ml and in one patient with TBG deficiency there was 52 ng/100 ml. It was concluded that the developed T_3 radioimmunoassay system was very reliable and could be used for the routine T_3 determination. (auth)

17661 METHODICAL INVESTIGATIONS FOR BONE MINERAL DETERMINATION BY IODINE-125. Roth, J. (Kantonsspital Basel (Switzerland). Abt. fuer Radiologische Physik). Fortschr. Geb. Roentgenstr. Nuklearmed.; 122: No. 4, 326-329(1975). (In German).

7 figs.; 2 tabs.; 8 refs.

The eligible parameters from the enlarged method of the bone mineral determination by ^{125}I-scanning are investigated. Different systems of diaphragm yield variable geometrical resolutions as well as very large differences of intensity. The change of the results of measurement is not so big. The areas of absorption are related to bone mass per unit length, dry weight, and ash weight of the bone. The statements are equivalent. Furthermore, it is shown, that aluminium is not very suitable for references to bone. (auth)

17662 DNA SYNTHESIS IN HEARTS OF RATS WITH RENAL HYPERTENSION AFTER LONG-TERM INFUSION OF ^{3}H-THYMIDINE. Steinert, W.; Friedrich, G.; Stoepel, K. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Medizin; Farbenfabriken Bayer A. G., Wuppertal (F. R. Germany). Inst. fuer Pharmakologie); Pfitzer, P. (Duesseldorf Univ. (F. R. Germany). Pathologisches Inst.). Beitr. Pathol.; 153: No. 2, 165-177(1974). (In German).

5 figs.; 2 tabs.; 39 refs.

The early effect of renal hypertension on DNA-synthesis in the heart muscle of rats was examined. Hypertension was produced by ligature of one renal artery and contralateral nephrectomy. Twenty days after surgery on 12 rats, nine of the animals had developed a systolic blood pressure between 210 and 241 mmHg. Three rats with systolic blood pressures of 163 to 180 mmHg served as controls. The 12 rats were simultaneously infused through a tail vein for a period of 10 days with a physiological saline solution containing ^{3}H-thymidine, 1.5 $\mu Ci/g$ body weight per day. Following the infusion, the animals were sacrificed and heart weight and labeling indices were recorded. The relative number of ^{3}H-thymidine-labelled endothelial cells of the blood vessels and of the connective tissue cells increased from 1.6 ± 0.03% in the controls to 3.28 ± 0.12% ($p < 0.005$). This increase was confined to the left ventricle. Nuclei of heart muscle cells from the left ventricle also showed an increase in the labeling index. No change in labeling index of heart muscle cells was seen in the right ventricle. The data indicate that induction of renal hypertension in rats results within less than 30 days in a stimulation of DNA synthesis especially of endothelial cells and connective tissue cells but only to a minor degree of heart muscle cell nuclei contained within the left ventricle. There is no wave of DNA synthesis and nuclear or cellular hyperplasia in myocardial cells of rats during the early hypertrophic process. (auth)

17663 RELATION BETWEEN RESPONSE TO HYPOTONIC STRESS AND THE ^{51}Cr RECOVERY IN VIVO OF PRESERVED PLATELETS. Valeri, C. R.; Feingold, H.; Marchionni, L. D. (Naval Blood Research Lab., Chelsen, MA). Transfusion.; 14: No. 4, 331-337(1974).

Platelet response to hypotonic stress can be used to estimate the ^{51}Cr recovery in vivo of liquid- and freeze-preserved platelets. This simple in vitro test may prove helpful in determining and controlling the quality of preserved platelets. Response to hypotonic stress was not related to the ^{51}Cr $T\text{-}\frac{1}{2}$ value of the preserved platelets, but was related to the number of irreversibly damaged platelets removed within two hours after transfusion. (auth)

17664 NUCLEAR CARDIOLOGY. II. Radiopharmaceuticals That Localize in Viable Myocardium. Bell, R. L. (Park View Hospital, Nashville). J. Tenn. Med. Assoc.; 67: No. 9, 748-752 (Sep 1974).

Because of the undesirable radiation characteristics of ^{42}K, the potassium analogues ^{43}K, ^{131}Cs, ^{129}Cs, ^{134}/sup m/Cs, ^{86}Rb, ^{84}Rb, and ^{81}Rb have been investigated in recent years for use in myocardial perfusion studies. Recent clinical reports suggest that ^{43}K, ^{81}Rb, and ^{129}Cs may be adequate for myocardial scanning. Since these agents localize in viable myocardium, poorly perfused myocardium would be seen as a cold spot on an isotope scan. Given the favorable radiation characteristics of ^{123}I and the fact that fatty acids are localized in the myocardium, ^{123}I-labelled 16-iodo-9-hexadecanoic acid may well prove to be the radiopharmaceutical choice in myocardial imaging. It would also be useful in evaluating myocardial blood flow and ischemic without infarction. Two other radiopharmaceutical, ^{210}Tl and ^{13}N-asparagine, are currently under investigation as myocardial scanning agents. (ERB)

17665 MOLECULAR GENETICS OF HUMAN CANCER AND ITS ETIOLOGIC IMPLICATIONS. Spiegelman, S.; Axel, R.; Baxt, W.; Kufe, D.; Schlom, J. (Columbia Univ., New York). Genetics, Suppl.; 79: 317-338(Jun 1975).

From 13th international congress of genetics, Part II; Berkeley and Davis, CA (20 Aug 1973).

The following topics are discussed: animal viral oncology; use of myeloblastosis and Rous sarcoma viruses of chickens and leukemia and sarcoma viruses of mice as models; molecular hybridization with radioactive DNA probes; simultaneous detection test for reverse transcriptase and high molecular weight RNA; application of the simultaneous detection test to the leukemias; germ-line transmission of viral information; and studies of identical twins. (HLW)

17666 RADIOACTIVE GAS INHALATOR. LeMon, D. E. US Patent 3,881,463. 6 May 1975. Filed date 26 Apr 1972. 8p.

An "inhalator", or more particularly an apparatus for permitting a patient to inhale a radioactive gas in order to provide a diagnostic test of the patient's lung area, is described. The disclosed apparatus provides a simple, trouble-free mechanism for achieving this result; and, furthermore, provides an improved testing method. Moreover, the disclosed apparatus has the capability of gradually introducing the test condition in a manner that makes it easy for the patient to become acclimated to it. (auth)

17667 GALLIUM-67: BROAD SPECTRUM DIAGNOSTIC. Hoffer, P. B. (Univ. of Chicago). West. J. Med.; 121-137(Aug 1974).

Utilization of the nonspecific qualities of ^{67}Ga-citrate in broad spectrum diagnostics is discussed. Its efficacy in delineating inflammatory lesions may be useful in conjunction with a more specific procedure. It is a valid concept to make use of the broad spectrum aspects of ^{67}Ga-citrate to locate rather than to identify the disease process. (ERB)

17668 RADIOIMMUNOLOGICAL STUDIES OF THYMOSIN. Schulof, R. S. New York, NY; Yeshiva Univ. (1974). 266p. University Microfilms Order No. 75-12,273.

Thesis (Ph. D.).

A large body of experimental evidence has suggested that the thymus gland may function as an endocrine organ. Recently, a biologically active thymic polypeptide hormone has been isolated and termed thymosin. The primary purpose of this investigation was to develop a specific radioimmunoassay for thymosin. The radioimmunoassay, iodine-125 labelled thymosin, and antisera raised against thymosin were all utilized to explore its biological and immunochemical properties. Antisera were prepared in rabbits against highly purified bovine and human thymosin fractions. Thymosin was labelled with ^{125}I by the chloramine-T method and purified when necessary by polyacrylamide gel electrophoresis. The double antibody technique was utilized for isolating antibody bound thymosin in radioimmunoassays developed for bovine and human thymosin. Because of immunological species differences, the bovine radioimmunoassay could be utilized to measure serum thymosin in cows and sheep, but not in mice or man. In each of three neonatal lambs, serum thymosin levels decreased by at least 67 percent following thymectomy by both radioimmunoassay and bioassay. Using the murine rosette bioassay, serum thymosin levels in man were shown to be maximal shortly after birth, but underwent a decreasing trend following puberty. On a cell for cell basis, murine bone marrow cells bind more ^{125}I-thymosin (bovine or murine) than similar cells from spleen or lympn nodes. The binding data correlate with the number of thymosin sensitive cells present in each tissue. (ERB)

17669 GALLIUM-67 SCANS IN THE THE DIAGNOSIS OF PYELONEPHRITIS. Kessler, W. O.; Gittes, R. F.; Hurwitz, S. R.; Green, J. P. (Univ. of California, San Diego). West. J. Med.; 121: 91-93(Aug 1974).

Gallium-67 (^{67}Ga) citrate was administered intravenously (50 microcuries per kg of body weight) to patients in whom acute and chronic urinary tract infections were suspected. Scanning was done, using both the Anger-type scintillation camera and the rectilinear scanner, 24 to 78 hours after injection of the isotope. The preliminary results imply that ^{67}Ga renal uptake is present in patients with pyelonephritis whether overt or silent, as well as in patients with ureterosigmoidostomies. However, ^{67}Ga renal uptake is not present in patients with radiographic evidence of chronic pyelonephritis without active infection and in patients without renal disease. (auth)

17670 SKELETAL SCINTIGRAPHY. The Use of Technetium 99m-Labeled Complexes in the Detection of Early Osseous Involvement by Metastatic Tumors. Hopkins, G. B.; Kristensen, K.A.B.; Campbell, C. G. (Scripps Memorial Hospital, La Jolla, CA). West. J. Med.; 120: No. 6, 448-451(Jun 1974).

Skeletal scintigraphy using technetium-99m (^{99}/sup m/Tc) complexes was carried out in a series of 332 cancer patients. The results of scintigraphy were compared with the results of roentgenography and with the diagnostic usefulness of serum alkaline and acid phosphatase levels and the presence or absence of bone pain. In 25 percent of cases, lesions were first identified with scintigraphs. When metastastic lesions were present on both scintigraphs and roentgenograms, the number was greater on scintigraphs in 72 percent of cases. Six false negative studies were recorded (1 percent). Sixty percent of patients with early metastasis--that is, those with abnormal scintigraphs and negative roentgenograms--were asymptomatic. Serum alkaline and acid phosphatase levels were normal in 40 percent and 42 percent respectively of those with early skeletal involvement. Skeletal scintigraphy with ^{99}/sup m/Tc complexes is superior to other commonly employed techniques used to assess bone metastasis. (auth)

17671 SEMIQUANTITATIVE CLASSIFICATION OF THROMBUS SIZE BY THE ^{125}I-LABELLED FIBRINOGEN TECHNIQUE. Wolf, E.; Hume, M. (Tufts Univ., Boston). Thromb. Res.; 4: No. 6, 757-767(Jun 1974).

Orthopedic patients with a high risk of venous thrombosis were injected with ^{125}I-labelled fibrinogen. Phlebography was performed on 44 patients demonstrating significant isotope localization in the calf. A significant positive correlation was found between the size of thrombi and the amount of limb radioactivity. Twelve phlebograms demonstrated no thrombi despite isotope positivity. The existence of a significant difference in mean radioactivity between limbs containing large and small thrombi allows determination of the extent of calf thrombosis. There was no significant difference

in mean radioactivity between limbs containing small thrombi and the twelve limbs demonstrating normal phlebograms. (auth)

17672 SPECIFIC RADIOIMMUNOASSAYS FOR QUANTITATION OF Hb S AND Hb F. Doherty, R. A.; Rowley, P. T.; Cernichiari, E. C.; Keller, M. R.; Porta, C. R. (National Institutes of Health, Bethesda, MD). pp 271-273 of Proceedings of the first National Symposium on Sickle Cell Disease. Hercules, J. I.; Schechter, A. N.; Eaton, W. A.; Jackson, R. E. (eds.). Bethesda, MD; Public Health Service (1974).

From first national symposium on sickle cell disease; Washington, DC (27 Jun 1974).

A specific, sensitive radioimmunoassay method for normal and abnormal hemoglobins (Hbs) was developed for studies of human embryonic and fetal Hbs, and for prenatal detection of sickle cell anemia. The method allows identification and quantitation of nanogram (ng) amounts of Hbs S and F in complex protein mixtures. Preparation of antisera specific for Hb A and other Hbs is in progress. (auth)

17673 PRESENT STATUS OF THE STUDY OF DISEASES OF THE CENTRAL NERVOUS SYSTEM BY USING RADIOISOTOPES. Nava, M. (Universidad Autonoma, San Luis Potosi, Mexico). Gac. Med. Mex.; 107: 132-138(Feb 1974). (In Spanish).

The uses of radioisotopes in brain scanning and cisternography are reviewed and the present status of these two procedures is analyzed. (JSR)

17674 USE OF RADIONUCLIDES IN THE FUNCTIONAL AND MORPHOLOGICAL STUDY OF THE LIVER. Cuaron-Santisteban, A. Gac. Med. Mex.; 107: 139-152(Feb 1974). (In Spanish).

A bibliographic review is presented of the use of radioisotopes in the study of hepatic function and bilary permeability, hepatic blood flow, and morphology of the liver. Scintillographic tomography of the liver is also briefly considered. (76 references) (JSR)

17675 DETERMINATION OF HEMODYNAMIC PARAMETERS IN THE RABBIT BY X-RAY FLUORESCENCE EXCITATION. Cesareo, R.; Tallarida, G.; Baldoni, F. (Univ., Rome). Int. J. Appl. Radiat. Isot.; 26: No. 5, 285-289(May 1975).

A simple method is described, employing the radioisotope x-ray fluorescence technique, which allows the simultaneous determination of some hemodynamic parameters (cardiac output, blood volume, circulation time) in the rabbit. A non radioactive iodine solution is injected intravenously and its concentration in drawn blood samples is determined by measuring the characteristic x-rays emitted by the iodine, excited by a radioactive source. The values of cardiac output agree well with those obtained by the thermodilution method. (auth)

17676 COLUMN RADIOIMMUNOASSAY METHOD FOR THE DETERMINATION OF DIGITOXIN. Boguslaski, R. C.; Schwartz, C. L. (Ames Research Lab., Elkhart, IN). Anal. Chem.; 47: No. 9, 1583-1586(Aug 1975).

A rapid, precise, and accurate radioimmunoassay for the measurement of digitoxin in serum samples was developed. The method employs a column of immobilized antibody, which acts as both reaction chamber and separation device. A diluted sample is applied to the column and allowed to incubate at room temperature for thirty minutes. Radiolabeled 3-O-succinyldigitoxigenin tyrosine (^{125}I) is then added and incubated for an identical period of time. A buffer wash separates the antibody bound from free drug. The sensitivity of the assay is about 150 pg, while the average intra- and inter-assay coefficients of variation are 10 and 15 percent, respectively. The assay exhibited satisfactory recovery and parallelism and correlated well with a reference procedure; the correlation coefficient was 0.99. (auth)

17677 NEW ISOTOPE METHOD FOR THE FUNCTIONAL DIAGNOSIS OF SALIVARY GLAND DISEASES. Cernea, P.; Gyorgy, S.; Laudenbach, P. Fogorv. Sz.; 66: No. 8, 225-228 (Aug 1973). (In Hungarian).

A new isotopic method for the diagnosis of salivary gland functions using ^{99m}Tc was developed. The function of each large gland can be imaged directly with this method. The method was developed from the research results on 130 healthy persons. The sound salivary gland function is imaged by a typical graph. The curve obtained can be divided into three segments which reflect various phases of the formation of saliva. (tr-auth)

17678 STUDYING THE APICAL CALIBER DISCREPANCY AND PERFUSION OF THE LUNG BY SCINTILLATION COUNTER. Csakany, G.; Hernady, T.; Erdelyi, M. Orv. Hetil.; 115: No. 36, 2108-2112(8 Sep 1974). (In Hungarian).

The methods used and the results obtained in the use of ^{133}Xe for scintiscanning the apical arear of the lungs for discrepancy in blood perfusion are reported. (JSR)

MATERIALS

Refer also to abstract 16694.

17679 (BARC-795) DIELECTRIC FUNCTIONS, PSEUDOPOTENTIALS AND APPLICATIONS TO LATTICE DYNAMICS. Sinha, S. K. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). 1975. 86p. Dep. NTIS (US Sales Only) $7.50.

These lectures are primarily concerned with the calculation of the phonon spectrum of a solid from its electronic structure. Defects, disordered solids, and anharmonic effects are not considered. The lectures discuss density response function, dielectric function, phonon spectra of free-electron like metals, Kohn anomalies, electron-phonon interaction, pseudopotentials, residual potential method for non-free-electron crystals, insulators, and relation of microscopic theory to dielectric constants and effective changes. (59 references) (DLC)

17680 (LBL-3530) INORGANIC MATERIALS RESEARCH DIVISION ANNUAL REPORT, 1974. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1975. Contract W-7405-eng-48. 258p. Dep. NTIS $7.60.

Brief summaries of individual research projects are given in sections for four major research areas as follows: (I) Chemistry-Inorganic Chemistry, Solid State Chemistry and Physics, Electrochemistry, Physical Chemistry, (II) Metallurgy-Crystal Imperfections, Theoretical Metallurgy, Ceramic Alloys, High Strength Materials, High Field Superconductivity, Powder Metallurgy, Advanced Materials, (III) Ceramic Science-High Temperature Reactions, Microstructure and Behavior of Ceramic Materials, Relations of Microstructure with Properties of Ceramics, (IV) Solid State Physics-Theoretical Solid State Physics, Far Infrared Properties of Solids, Superconductivity, and Experimental Solid State Physics and Quantum Electronics. Most of the information was published previously. A list of 1974 publications and reports follows each section. (JRD)

17681 TECHNOLOGY IN TRANSITION. 20th National SAMPE Symposium and Exhibition, San Diego, California, April 29–May 1, 1975. Volume 20. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975). 662p. (CONF-750459-). $40.75.

The objective was to search out the advanced technologies developed in the aerospace and defense industries which can be applied to the general commercial field. This volume contains 55 papers, divided into sessions dealing with resin and metal matrix composites, advanced composites, inspection and quality, resins and polymers, metals joining, metalworking, and adhesives. Separate abstracts were prepared for 6 of the papers. (DLC)

For abstracts of individual papers see: 17738–17740 and 17760–17762.

Ceramics and Cermets

Refer also to abstracts 16802, 16813, 16828, 16891, 16914, 17741, 17865, 17871, 18736, 18909, 18926, and 19036.

17682 (ANL-AFP-8) REVIEW OF THE THERMODYNAMICS OF THE U–C, Pu–C, AND U-Pu-C SYSTEMS. Tetenbaum, M.; Sheth, A.; Olson, W. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 32p. Dep. NTIS $4.75.

Thermodynamic properties such as enthalpy, heat capacity, entropy, heat and free energy of formation, and vaporization behavior are presented for the U–C, Pu–C, and U–Pu–C systems. These properties are of interest to scientists and engineers involved in the expanding field of advanced fuel LMFBR systems. The information on these systems has been derived largely from the discussions of the IAEA Panel on the assessment of thermodynamic properties of the U–C, Pu–C, and U–Pu–C systems. (auth)

17683 (BNWL-tr-142) INVESTIGATIONS OF GLASSY SYSTEMS WITH SrO AS A MAIN CONSTITUENT. Zagar, L.; Lueneberg, H. Translated from Glastech. Ber.; 44: No. 9, 345-353 (Sep 1971). 29p. Dep. NTIS $4.50.

Glass systems with high SrO content were investigated because of their suitability for storing fission products of nuclear fuels and for certain scientific and technological purposes. As the investigations were chiefly concerned with glass technology, radiation properties received little attention. The investigations were based on the system $SrO-Na_2O-B_2O_3-ZrO_2-TiO_2-SiO_2$ because these oxides have the largest effects on the required glass properties. The limits of glass formation in the systems $SrO-Na_2O-SiO_2$, $SrO-B_2O_3-SiO_2$, $SrO-Al_2O_3-SiO_2$, and $SrO-Al_2O_3-B_2O_3-SiO_2$ were determined; an SrO content of 65 mole % was possible in the last of these. About 170 combinations were melted and melting behavior, devitrification, corrosiveness, fluidity, density, and chemical durability investigated. Promising compositions were tested to determine more precisely density, chemical durability in water, leaching out of Sr, thermal expansion, transformation point, Littleton softening point, and viscosity-temperature relation. (10 fig) (auth)

17684 (CONF-740757-1) GRAIN BOUNDARY DEFORMATION PROCESSES. Langdon, T. G. (University of Southern California, Los Angeles (USA). Dept. of Materials Science). 1974. 27p. Dep. NTIS $4.50.

From symposium on deformation of ceramic materials; University Park, Pennsylvania, USA (Jul 1974).

Various grain boundary deformation processes are reviewed and experimental procedures for measurements of grain boundary sliding described. The few direct measurements reported for sliding in polycrystalline nonmetals including U–Pu carbide are summarized, and it is demonstrated that there is a considerable need for further work in this area. A new form of deformation mechanism map is presented which is simple to construct and which graphically illustrates the occurrence of grain boundary deformation processes. (auth)

17685 (CONF-750617-6) RESIDUAL STRAINS IN A STAINLESS STEEL PERFORATED PLATE SUBJECTED TO REVERSE LOADING AT HIGH TEMPERATURE. Durelli, A. J.; Buitrago, J. (Catholic Univ. of America, Washington, D. C. (USA)). 1974. 16p. Dep. NTIS $4.00.

From second ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

For Holifield National Lab., Oak Ridge, TN.

An investigation was made to determine strains in a stainless steel perforated plate subjected to a temperature of 1100°F and to a successively applied tensile and compressive in-plane loading sufficiently large to produce creep and plastic strains. The duration of the test was 1000 hours. Square grids of lines (at distance of 0.25 in.) and crossed-gratings (500 lines-per-inch) were engraved on both surfaces of the plate before the test. After the plate was unloaded and brought back to room temperature the grids were analyzed using traveling microscopes, and the gratings using the moire effect. Both Cartesian strains were determined from the moire isothetics along the axes of the plate, along the two lines tangent to the hole and parallel to those axes and along the edges of the plate. Grid measurements were made at specific points. The deformed shapes of the hole and of the plate are also given. It is estimated that strains larger than 0.001 can be determined with the techniques and methods used. (auth)

17686 (IC-74-54) PATH INTEGRAL APPROACH TO THE COMPRESSIBLE ISING MODEL. Aggarwal, K. G.; Samathiyakanit, V. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1974. 16p INIS.

The path integral method is used to decouple the spin-phonon variables in the Wagner-Swift Hamiltonian for a compressible Ising model where the exchange interaction is expanded up to terms quadratic in displacements. A brief review is given of the earlier work. The approximations made by the previous workers to obtain the effect of the spin-phonon coupling on the Debye-Waller factor and the phonon frequencies are shown to correspond to the lowest-order terms in the cumulant expansion in the present approach. Finally the procedure to extend the formalism to anharmonic crystals is outlined. (INIS)

17687 (K-TL-440) CORROSION TESTING OF FILTER PAPERS MADE WITH J-M 475 AND J-M 753 GLASS FIBERS. Petit, G. S.; Wiggins, F. N.; Weber, C. W. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 14 May 1975. Contract W-7405-eng-26. 21p. Dep. NTIS $4.25.

Results of static tests conducted on the fibers, and dynamic tests conducted on the papers are reported. The tests were conducted using H_2O, HNO_3, H_2So_4, HCl, NaOH, and NH_4OH as the corrosive media. (JRD)

17688 (KFK-EST-6/75-2) SECOND QUARTERLY REPORT ON STRUCTURE, PREPARATION, AND PROPERTIES OF REFRACTORY COMPOUNDS AND SYSTEMS, 1974. Holleck, H.; Thuemmler, F. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2). May 1975. 97p. (In German). Dep. NTIS (US Sales Only) $8.00.

Progress in work on (Ta, Hf)C solid solutions with and without binder is presented in two contributions. The work includes the preparation and properties such as E-modulus, electrical resistivity, thermal expansion, as well as oxidation behavior. Two additional reports deal with the sintering, wetting, and wear behaviour of (Ta, Hf) carbonitrides with binders. The possibility of improving the hardness in the system Ta–Hf–C with the aid of precipitation is discussed with data on the influence of microstructure on the hot hardness (up to 1600°C). The influence of heat treatment at various temperatures and the effects on the hardness in multicomponent systems caused by long and short range ordering or segregation phenomena was studied in the model system Ti–Ta–C. Problems confronted are reported in detail. The reaction behavior of the refractory carbides with the metals of the iron group (Fe, Co, Ni) is discussed and the known thermodynamic data of the intermetallic phases are compiled. These data are necessary to calculate stoichiometry ranges of the carbides, where no reactions with binders are likely to occur. (auth)

17689 (TI-700-28-005) RESULTS OF LITERATURE SEARCH ON THE ZIRCONIUM-HYDROGEN PHASE DIAGRAM. Hawley, J. P. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Jun 1967. 8p. Dep. NTIS $4.00.

A literature search was conducted to determine the areas of uncertainty in the zirconium–hydrogen phase diagram. It was concluded that considerable uncertainties exist in the $\alpha + \gamma + \delta/\delta$ phase boundary below 300°C, and in the $\delta/\delta + \epsilon/\epsilon$ phase boundaries above room temperature. (auth)

17690 (Y-1977) HIGH-TEMPERATURE X-RAY DIFFRACTION STUDY OF $HfTiO_4$-HfO_2 SOLID SOLUTIONS. Carpenter, D. A. (Oak Ridge Y-12 Plant, Tenn. (USA)). 3 Jul 1975. Contract W-7405-eng-26. 21p. Dep. NTIS $4.00.

High-temperature x-ray diffraction techniques were used to determine the axial thermal expansion curves of $HfTiO_4$-HfO_2 solid solutions as a function of composition. Data show increasing anisotropy with increasing HfO_2 content. An orthorhombic-to-monoclinic phase transformation was detected near room temperature for compositions near the high HfO_2 end of the orthorhombic phase field and for compositions within the two-phase region ($HfTiO_4$ solid solution plus HfO_2 solid solution). An orthorhombic-to-cubic phase transformation is indicated by data from oxygen-deficient materials at greater than 1873°K. (auth)

17691 X-RAY DIFFRACTION STUDIES OF IRRADIATED LITHIUM HYDRIDE: ORIENTED LITHIUM PRECIPITATES. Smith, G. S. (California Univ., Livermore). J. Phys. Chem. Solids; 36: No. 7/8, 797-799(Jul 1975).

Single-crystal X-ray diffraction studies of gamma-irradiated LiH show the clear presence of metallic lithium precipitates. The lithium is in the normal bcc form and is crystallographically oriented with respect to the matrix: $\langle 110\rangle_{Li} \parallel \langle 111\rangle_{LiH}$ and $\langle 100\rangle_{Li} \parallel \langle 110\rangle_{LiH}$. The absence of diffraction broadening is evidence that the Li particles are relatively large (> 50 nm). X-ray diffraction measurements of the Li content of a heavily irradiated LiH crystal indicate that a substantial fraction of the "free" Li is present in the oriented precipitates. (auth)

17692 GALVANOMAGNETIC INVESTIGATION OF TiB_2, NbB_2, AND ZrB_2. Gordon, W.; Soffer, S. B. (Polytechnic Inst. of Brooklyn). J. Phys. Chem. Solids; 36: No. 7/8, 627-631(Jul 1975).

Low temperature measurements were made of the transverse magnetoresistivity and Hall coefficient of single crystals of nominal compositions TiB_2, NbB_2 and ZrB_2 as a function of magnetic field strength. The data are compared to predictions of the two-band spherical Fermi surface model. For TiB_2 and NbB2 predictions of the model can be made to conform reasonably well to the experimental results. Results for ZrB_2 do not fit the model as well, perhaps because of a larger deviation from stoichiometry. In spite of low resistance ratios (≤ 100) the crystals exhibit behavior characteristic of intermediate field strengths ($\omega\tau > 0.1$) at liquid helium temperatures. This implies that light mass carriers predominate. (auth)

17693 ATOM VACANCIES AND THEIR EFFECTS ON THE PROPERTIES OF NbN CONTAINING CARBON, OXYGEN, OR BORON. II. Superconducting Transition Temperature. Storms, E. K.; Giorgi, A. L.; Szklarz, E. G. (Los Alamos Scientific Lab., NM). J. Phys. Chem. Solids; 36: No. 7/8, 689-694(Jul 1975).

The formation of vacancies in the niobium sublattice is found to coincide with the maximum superconducting transition temperature in the NbN–NbC system. The relationships between T_c, the electron concentration and the vacancy content of both sublattices are explored. Oxygen, when added to NbN, increases the metal vacancy concentration and causes a decrease in T_c. Boron raises T_c by decreasing the nonmetal vacancy content without changing the metal vacancy content. If the metal and nitrogen vacancies in ZrN are random, as all past work suggests, the T_c of this material is much higher than that found at equivalent compositions of NbN. A model is developed which attempts to show the relationship between the ionic and covalent components of the bond between the metal and nonmetal sublattices and the influence each has on the superconducting transition temperature. (auth)

17694 MORPHOLOGY OF INTERLINKED POROSITY IN NUCLEAR FUELS. Tucker, M. O.; Turnbull, J. A. (Central Electricity Generating Board, Berkeley, Eng.). Proc. R. Soc. (London), Ser. A; 343: No. 1634, 299-314(13 May 1975).

Micro-examination of irradiated uranium dioxide has shown that pores formed along triple-point grain edges play an important part in the swelling of the fuel. When the volume change is greater than 7% this porosity has the form of long tunnels linking adjacent grain corners and forming an interconnected network throughout the body of the fuel. The formation of these tunnels is important in two respects. First, despite the high density of individual gas bubbles that are also present in the fuel, by far the major contribution to the observed fuel swelling is from the grain edge tunnels. Second, the interlinked porosity provides a direct route for the release of fission gas from interior regions of fuel. In nuclear reactor fuel elements both of these features can be responsible for damaging the fuel containment. Models are developed describing the formation and interlinkage of the tunnels. A significant result of the theory is that in any material there exists a minimum level of swelling, independent of the applied pressure on the fuel, below which interconnected tunnels are unstable. For uranium dioxide a minimum swelling of 5% is predicted which is in excellent agreement with experimental observations. (auth)

17695 THERMAL NOISE IN ION-IMPLANTED MOSFETS. Huang, C.; van der Ziel, A. (Univ. of Minnesota, Minneapolis). Solid-State Electron.; 18: No. 6, 509-510(Jun 1975).

Measurements are reported on high-frequency noise in ion-implanted MOSFETs. The results are interpreted in terms of the thermal noise of the conducting channel. (auth)

17696 DISLOCATION CREEP IN NON-METALS. Gittus, J. (United Kingdom Atomic Energy Authority, Salwick, Eng.). pp 134-202 of Creep, Viscoelasticity, and Creep Fracture in Solids. Gittus, J. (ed.). London; Applied Science Publishers (1975).

The review begins with an exploration of the possibilities of dislocation creep processes in crystalline and glassy polymers. Work in progress on the dislocation creep of ionic solids is next examined, including a section on UO_2. The effects of stoichiometry are then considered (absolute value of creep rate, stress dependence, and temperature sensitivity); there are sections on UO_2, CeO_2 and UC. The behavior of graphite is described, showing the effects of internal discontinuities upon the dislocation creep rate. (UK)

17697 SUSCEPTIBILITY MAXIMUM AND LOGARITHMIC TEMPERATURE DEPENDENCE OF MAGNETOCALORIC EFFECT: APPLICATION TO U_2C_3. Misawa, S. (Nihon Univ., Japan). Solid State Commun.; 16: No. 10/11, 1215-1218(1 Jun 1975).

It is shown that the Fermi liquid model of magnetism, when applied to U_2C_3, can explain the susceptibility maximum at about 65°K through a term of the form T^2 ln T with respect to temperature. It is proposed that a more precise proof on the existence of this term may be found by observing the T ln T dependence of the magnetocaloric effect at low temperatures. (auth)

17698 VALENCE CHANGES IN CHROMIUM-DOPED MAGNESIUM OXIDE. Anderson, B. R.; Challis, L. J.; Champion, D. J.; Clark, I. A.; Jay, P. R.; Woodhead, S. M. (Univ. of Nottingham, Eng.). J. Phys., C (London); 8: No. 10, 1472-1474(21 May 1975).

The effect of oxidizing heat treatment, reducing heat treatment and of γ-irradiation on the thermal conductivity of Cr-doped MgO is investigated. Estimates of the proportion of chromium in the divalent state after each treatment are obtained. (auth)

17699 INFLUENCE OF PHONON ANOMALIES ON THE SPECIFIC HEAT OF TRANSITION METAL CARBIDES. Roedhammer, P.; Gmelin, E.; Weber, W. (Max-Planck-Institut fuer Festkoerperforschung, Stuttgart). Solid State Commun.; 16: No. 10/11, 1205-1208(1 Jun 1975).

The specific heat of TaC and HfC has been measured in the temperature range 1.8°K < T < 100°K. The superconducting transition of TaC was suppressed by application of a magnetic field of 7 kOe. The experimental results agree well with shell-model calculations of the lattice specific heat. It is shown that the average frequency of the transverse acoustic phonon anomalies in TaC can be determined from experiment. Due to these anomalies the commonly applied extrapolation of $\theta_D(T = 0)$ from $T > T_c$ has led to erroneous results. (auth)

17700 THERMODYNAMIC PROPERTIES OF V_nO_{2n-1} (n = 4 to 9) AT HIGH TEMPERATURES AND AT 298.15 K. Vasil'eva,

I. A.; Sukhushina, I. S.; Balabaeva, R. F. (Moscow State Univ.). J. Chem. Thermodyn.; 7: No. 4, 319-328(Apr 1975).

The thermodynamic properties of V_nO_{2n-1} (n = 4 to 9) were established in the temperature range 1200 to 1400°K. A solid-electrolyte cell of the type Pt, Ni, NiO|0.85 ZrO_2 · 0.15 CaO| V_nO_{2n-1}, $V_{n-1}O_{2(n-1)-1}$, Pt, was used in the experiments. The standard Gibbs energy, enthalpy, and entropy changes of the reactions $2nV_{n-1}O_{2(n-1)-1} + O_2 = 2(n-1)V_nO_{2n-1}$ were calculated. Thermodynamic functions of formation from the elements for V_nO_{2n-1} were calculated at 1300 and 298.15°K. (auth)

17701 PHYSICAL PROPERTIES OF ZIRCONIUM CARBIDE. Zotov, Yu. P.; Kotel'nikov, R. B.; Kakushadze, L. E.; Migunov, L. V.; Galiakbarav, Z. G. Izv. Akad. Nauk SSSR, Metal.; 71-75 (1974). (In Russian).

The thermal conductivity, electrical resistivity, and the monochromatic spectral emission coefficient of zirconium carbide were studied as functions of carbon content. The thermal conductivity and electrical resistivity coefficients were studied at temperatures of 300 to 2500°K, with carbon content in the range 40 to 60 at.%. Extrema were found for these coefficients. The spectral blackening coefficient is temperature-independent from 1500 to 3200°K, increasing with increased carbon content. (IAA)

17702 EVIDENCE FOR A VIBRONIC SPECTRUM IN THE PHOTOLUMINESCENCE OF THORIA. Claudel, B.; Sautereau, H.; Williams, R. J. J. (Institut National des Sciences Appliquees, Villeurbanne, France). J. Lumin.; 10: No. 3, 177-183(Apr 1975).

The photoluminescence spectrum obtained at 77°K for undoped and doped thoria samples produced by thorium nitrate thermolysis reveals the presence of a fine structure which is interpreted as a vibronic spectrum. The two vibrational frequencies which can be deduced from this spectrum agree with the values found by ir and Raman techniques. The possible origin of the vibronic spectrum is discussed. (auth)

17703 NATURE OF SUPERFICIAL OXIDES ON TUNGSTEN DURING ANODIC SOLUTION. Belevskii, S. F.; Reshetnyak, V. G.; Atanasyants, A. G. (Moscow Inst. of Chemical Tech.). Prot. Met.; 10: No. 5, 500-501(1974).

Translated from Zashch. Metal.; 10: No. 5, 548-549(1974).

The electrode resistance and photoelectric polarization of intermediate tungsten oxides were measured. Results of electrode resistance measurements indicate that $WO_{2.2}$ to $WO_{2.8}$ and $WO_{2.8}$ to $WO_{2.9}$ form on the W surfaces. Photoelectrochemical evolution of oxygen from W surfaces under positive potential indicates that secondary processes which mask the true photoelectric polarizatio value take place on the electrode. (JRD)

17704 LATTICE DYNAMICS AND LIGHT SCATTERING IN HAFNIA AND ZIRCONIA. Anastassakis, E.; Papanicolaou, B.; Asher, I. M. (Northern Univ., Boston). J. Phys. Chem. Solids; 36: No. 7/8, 667-676(Jul 1975).

Results of lattice-dynamical analysis and light scattering measurements on HfO_2 and ZrO_2 are reported. The analysis is based on group theoretical considerations and is accomplished by the use of a related computer program, previously published. The Born–von Karman approach is complemented by an external-mode treatment of both the monoclinic and tetragonal phase. Raman scattering techniques are employed to obtain the long-wavelength optical phonon frequencies. (auth)

17705 PHASE EQUILIBRIUM IN THE $GeO_2-V_2O_5$ SYSTEM. Marinov, M. R.; Krivoshieva, V. M.; Stavrakieva, D. V. (Inst. of Chemical Technology, Sofia). Compt. Rend. Acad. Bulg. Sci.; 28: No. 1, 47-50(1975).

DTA, x-ray diffraction, microscopy, and solidification were used to investigate the $GeO_2-V_2O_5$ phases covering the entire composition range. The form of GeO_2 in the solidus depends on the crystallization conditions; if the glass samples are crystallized at 500 to 550°C, GeO_2 appears as the hexagonal modification, particularly in the V_2O_5-rich field. The phase diagram is of the simple eutectic type with a solidus temperature of 610 ± 5°C and an invariant point of ~42 mol % V_2O_5. (DLC)

17706 V- AND V^0 CENTERS IN CaO SINGLE CRYSTALS. Abraham, N. M.; Chen, Y.; Boatner, L. A.; Reynolds, R. W. (Oak Ridge National Lab., TN). Solid State Commun.; 16: No. 10/11, 1209-1213(1 Jun 1975).

The stable, intrinsic V^- center in CaO single crystals was produced at room temperature by high-dose electron irradiation. This center, which consists of a hole trapped at an oxygen ion adjacent to a calcium vacancy, exhibits an EPR spectrum at 77°K which has ⟨100⟩ axial symmetry and is described by S = ½, $g_{\parallel}$ = 2.0021 (2) and $g_{\perp}$ = 2.0697 (2). At room temperature, the spectrum consists of a single thermally-averaged isotropic line at g = 2.047 (1). Upon γ-irradiation at 77°K, the isolated V^- concentration is reduced and V^0 centers (pairs of trapped holes at single vacancies) are produced. A room-temperature thermal anneal reverses the effect of the low-temperature γ-irradiation. (auth)

17707 UTeS PHASE AND THE LIMITS OF ITS HOMOGENEITY RANGE. Khodadad, P.; Guerman, H. (Laboratoire de Chimie Minerale, Chatenay-Malabry, France). J. Less-Common Met.; 40: No. 3, 293-297(May 1975). (In French).

The UTeS compound, the structure of which has recently been determined, belongs to a homogeneity range extending up to the composition $UTe_{0.75}S_{1.25}$. An interpretation of this observation is suggested. The structure of the UTeS phase can be considered as a particular form of the $PbCl_2$-type structure. (auth)

17708 CONTRIBUTION TO THE ANALYSIS OF BRITTLE POWDER COMPACTING. Mikijelj, V. (Univ., Belgrade). Sci. Sintering; 6: No. 3, 143-148(Sep 1974).

The nature of changes during compacting of agglomerated brittle powders is different from those occurring during pressing of metallic materials. Interdependence of density and pressure in the most interesting region is linear and parameters of these lines are correlated with specific surface areas and agglomeration degree of powders. (auth)

17709 METHOD OF CALCULATING THE APPARENT PORE SIZE DISTRIBUTION IN SINTERED MATERIALS FROM LINEAL AND PLANAR ANALYSIS DATA. Landspersky, H. (Nuclear Research Inst., Rez, Czech.). Sci. Sintering; 6: No. 3, 163-174 (Sep 1974).

A method for transforming lineal or planar analysis data to the frequency function of three-dimensional bodies in an opaque sample is proposed. It is based on the interpolation of experimental values by an n-order polynomial and on the substitution of this polynomial into the Cahn-Fullmann equation. Practical examples of the application of the results on sintered materials are given. (auth)

17710 SOME PROBLEMS OF CEMENTED CARBIDES SINTERING. Duzevic, D. (Hardmetal and Tool Factory, Zagreb); Despotovic, Z. Sci. Sintering; 6: No. 3, 183-195(Sep 1974).

Practical problems of sintering conventional cemented carbides referring to a generalized pseudobinary phase diagram are analyzed. The need for more precise microstructural programming is pointed out, and some traditional concepts of sintering parameters are partially revised. (auth)

17711 THERMODYNAMIC PECULIARITIES OF SYNTHESIS OF CARBIDES OF REFRACTORY METALS AT HIGH TEMPERATURES. Manukhin, A. V.; Pavlov, Yu. A.; Petrikin, Yu. N.; Pegov, V. S.; Nikitin, K. A. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 3, 27-30(1975). (In Russian).

A method is presented for calculating approximate values of the isobar potential for refractory metal carbides at high melting temperatures with consideration of carbon sublimation at 4200°K. The calculations for the carbides TiC, ZrC, NbC, TaC, WC, and W_2C showed agreement of the temperatures at which the isobar potential was zero with the boiling temperatures of these carbides. This confirms experimental data on decomposition of the carbides (implantation phase) at transition to the gas phase, which indicates the predominantly metallic character of the bond in these compounds. Thermodynamic analysis of the formation reactions in refractory metal carbides with consideration of carbon sublimation shows that of carbide formation under low-temperature plasma conditions is possible only at temperatures below the boiling temperature of the carbides. (tr-auth)

17712 MAGNONS IN EuO AT DIFFERENT PRESSURES. Begum, N. A. (National Aeronautical Lab., Bangalore, India). Indian J. Pure Appl. Phys.; 13: No. 2, 136-137(Feb 1975).

Magnon dispersion curves for EuO, at nine different presures and in three different directions (viz. 100, 110 and 111) have been obtained. These curves show an increase of spin wave energy with pressure. Curie temperature (T_c) for different pressures (1 to 90 k bar) has also been determined. (auth)

17713 GREEN EMITTING PRASEODYMIUM IN CALCIUM ZIRCONATE. Hoefdraad, H.; Blasse, G. (Rijksuniversiteit, Utrecht). pp 39-45 of Charge-Transfer Spectra of Lanthanide Ions in Oxides. Hoefdraad, H. (ed.). Utrecht; Rijksuniversiteit (12 Mar 1975).

Pr_2O_3 in solid solution (concentration 1 at.%) in $CaZrO_3$ with perovskite structure shows green luminescence only under ultraviolet light with the maximum of the excitation band at 245 nm. A detailed spectrum of the emission with a sharp maximum at 493.5 nm is given. The excitation can be ascribed to a 4f → 5d transition. No 5d → 4f luminescence could be detected, not even 4°K. With Pr_2O_3 in calcium-modified ZrO_2 (0.15 CaO · $0.85ZrO_2$) having a fluorite structure, the 4f5d state is situated at much lower energies, 295 nm. Here the red emission is

present with almost the same intensity as the green emission. (INIS)

17714 EVIDENCE FOR THE INFLUENCE OF AN EFFECTIVE CHARGE ON THE POSITION OF THE CHARGE-TRANSFER BAND OF Eu^{3+} IN SOLIDS. Hoefdraad, H. E.; Stegers, F. M. A.; Blasse, G. (Rijksuniversiteit, Utrecht). pp 33-37 of Charge-Transfer Spectra of Lanthanide Ions in Oxides. Hoefdraad, H. (ed.). Utrecht; Rijksuniversiteit (12 Mar 1975).

The ultraviolet wavelength which excites the red luminescence of Eu_2O_3 in solid solution in $CaSO_4$ containing phosphate, and in ZrP_2O_7 is determined. In the first solution, the wavelength found was 263 nm. Due to experimental difficulties, 222 nm or less was found in the second case. Results are compared with those from the literature and a discussion is given. Evidence is presented for the influence of an effective charge on the position of charge-transfer bands. (INIS)

17715 CHARGE-TRANSFER ABSORPTION BAND OF Eu^{3+} IN OXIDES. Hoefdraad, H. (Rijksuniversiteit, Utrecht). pp 25-32 of Charge-Transfer Spectra of Lanthanide Ions in Oxides. Hoefdraad, H. (ed.). Utrecht; Rijksuniversiteit (12 Mar 1975).

The position of the charge-transfer band of Eu^{3+} in the absorption spectrum of a number of oxides is discussed. It is shown that this position is more or less fixed in octahedral VI coordination and that it varies in VIII and XII coordinates as a function of the effective ionic radius of the relevant host lattice ion. (INIS)

17716 SPIN POLARIZED PHOTOELECTRONS FROM EuO. Sattler, K.; Siegmann, H. C. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik). Z. Phys., B; 20: No. 3, 289-312(Apr 1975). (In German).

27 figs.; 3 tabs.; 100 refs.

The measurement of the spin polarization of photoelectrons from ferromagnetic semiconductors with a novel apparatus shows that the surface is magnetically not saturated even at temperatures far below the Curie temperature. In EuO the ionization threshold of the 4f'-states on doping; furthermore two types of doping coexist, differing in their spin polarization and the photoelectric yield spectrum. The surface magnetism is influenced by evaporation of a very thin metal film. EuO is an intense source of highly polarized electrons suitable for use with a pulsed high energy accelerator. (auth)

17717 ELEMENTARY BORON AND METAL-BORON COMPOUNDS. Will, G. (Bonn Univ. (F. R. Germany). Mineralogisches Inst.). Chem.-Ztg., Chem. App.; 98: No. 10, 471-479(Oct 1974). (In German).

16 figs.; 4 tabs.; 25 refs.

Elementary boron is of interest for its peculiar and difficult bonding behavior in solids. Due to its high oxygen affinity no elementary boron is found in nature. For the same reason it is difficult to isolate pure, elementary boron, and much confusion about "boron crystals" has been the result of more than 100 years of research. The polymorphic forms of elementary boron and its closely related higher carbides and higher metal borides as well as the simple metal borides, B_4C and BN are reported. The quantum-mechanical background responsible for structure and stoichiometry of these crystals is given. (auth)

17718 APPLICATIONS AND PROPERTIES OF SINTERED ZIRCONIA. II. Wear Behaviour and Application Examples. Sturhahn, H. H.; Thamerus, G. (Feldmuehle Kyocera Europa Elektronische Bauelemente G.m.b.H., Plochingen (F. R. Germany)); Dawihl, W. (Universitaet des Saarlandes, Saarbruecken (F. R. Germany)). Ber. Dtsch. Keram. Ges.; 52: No. 4, 77-79(Apr 1975). (In German).

2 figs.; 3 tabs.; 7 refs.

The newly developed zirconia materials do not give strong joints with metals but show good wear behavior and good resistance to corrosion as has been found by various methods of determining these properties. In addition zirconia shows good thermal shock resistance, comparable with that of porous silicon nitride. The field of application of zirconia extends today to the production of wire, where it is used for drawing cones. Further uses include cold forming, machining of light-metal alloys and as a sealing strip in rotary piston engines. (auth)

17719 PHASE EQUILIBRIA IN THE V_2O_4-V_2O_5 SYSTEM AT TEMPERATURES FROM 500° TO 651°C. Endo, H.; Wakihara, M.; Taniguchi, M. (Tokyo Inst. of Tech. (Japan). Faculty of Science). Chem. Lett. (Tokyo); No. 8, 905-908(Aug 1974).

The standard free energies (Δ G°) for V_2O_4 oxidation according to the consecutive reaction $V_2O_4 \rightarrow V_6O_{13} \rightarrow V_3O_7 \rightarrow V_2O_5$ were determined precisely on the basis of equilibrium oxygen pressure at 651°C. The standard free energy change for the reaction $2\ V_3O_7 + {}^1/_2\ O_2 = 3\ V_2O_5$ can be expressed by $\Delta G^\circ_R = -12{,}271 + 2.57\ T$ (500 – 651°C) ± 1340 cal. (auth)

17720 STUDIES OF CERAMIC FUELS WITH USE OF FISSION GAS RELEASE LOOP, 4. Fission Gas Release From Uranium Carbide in the Presence of Trace Amounts of Water Vapor. Handa, M.; Yamagishi, S.; Fukuda, T.; Shiba, K.; Takahashi, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Nucl. Sci. Technol. (Tokyo); 11: No. 9, 387-394(Sep 1974).

In-pile release of fission gas from sintered UC pellets in the presence of 8 ~ 230 ppm water vapor in the He sweep gas was measured over the temperature range of 160° ~ 1,000°C. A very complex release behavior was observed and the mechanisms of release were deduced from the manner in which the release depended on the decay constant. It was established that the release of short-lived fission gases during irradiation was controlled mainly by pseudo-recoil, while chemical reaction between UC and water vapor, as well as knock-out, appeared to contribute much more significantly in the case of the longer-lived fission gases. The release of fission gas after reactor shutdown was shown to be governed by the UC-H_2O reaction. The ratio of the release due to this reaction in reference to the total release was found to be dependent not only on the concentration of the water vapor but also on the amount present of the accumulated reaction products. Also, a discussion is given on the inordinately high release of ^{135m}Xe observed at 600°C. (auth)

17721 SOME FEATURES OF MASS SPECTROMETER FOR INVESTIGATION OF NEUTRAL AND IONIC SPECIES VAPORIZED FROM HIGH TEMPERATURE SURFACE. Sasaki, N. (Kyoto Univ. (Japan)); Kubo, K.; Asano, M. Tech. Rep. Inst. At. Energy, Kyoto Univ.; No. 163, 1-9(Jan 1974).

A specially improved mass spectrometer was used in a series of studies on the Langmuir vaporization and the surface ionization of some carbides heated on graphite filaments. Some features of the mass spectrometer are described, particular attention being given to a description of newly developed ion source. The ion source is constructed by the combination of an electron impact source with a surface ionization source for the purpose of the detection of both neutral vapor species and thermal ion species. Even at high temperatures, the insulation of the surface ionization source is fully maintained by the use of molybdenum thick plates and alumina or boron nitride plates and cylinders. (auth)

17722 THIN FILM FORMATION OF In_2O_3, TiN, AND TaN BY RF REACTIVE ION PLATING. Murayama, Y. (Department of Electrical Engineering, Faculty of Engineering, Toyo University, Kawagoe, Saitama, Japan). J. Vac. Sci. Technol. 12: No. 4, 818-820 (July 1975).

In_2O_3, TiN, and TaN films were prepared on glass substrates by a rf ion-plating technique. Indium, titanium, and tantalum were evaporated from evaporation sources in an oxygen or nitrogen atmosphere at a pressure on the order of 10^{-4} Torr. These films were observed to be pinhole free and uniform, showing excellent electrical and physical properties. The rf ion-plating system appears to have some advantages over other methods of reactive deposition. (auth)

17723 SYNTHESIS AND MORPHOLOGY OF VARIOUS CARBIDES IN THE Ta–C SYSTEM. Grossklauss, W.; Bunshah, R.F. (Materials Department, University of California at Los Angeles, Los Angeles, California 90024). J. Vac. Sci. Technol. 12: No. 4, 811-814 (July 1975).

Tantalum carbides, i.e., TaC and Ta_2C, were readily synthesized by evaporating elemental Ta in the presence of acetylene gas. A high-rate physical-vapor-deposition technique employing the activated-reactive-evaporation process was used. The C/Ta ratio of the TaC deposits was found to increase with increasing C_2H_2 partial pressure. The hardness of the TaC was 2482 kg/mm² KHN, which is comparable to the literature values, while the hardness of Ta_2C was twice that previously reported. It was found that the morphology changed markedly with deposition temperature. (auth)

17724 PHASE STABILITY OF CHROME-CARBIDE Ni–Cr COATINGS IN LOW-OXYGEN ENVIRONMENTS. Taylor, T.A. (Union Carbide Corporation, Linde Division, Coatings Service Department, Indianapolis, Indiana 46224). J. Vac. Sci. Technol. 12: No. 4, 790-794 (July 1975).

The thermal stability of the phases in chrome-carbide-based, wear-resistant coatings, applied by plasma and detonation gun (D-gun) devices, was investigated for applications in low-oxygen environments. It was found that current coatings using the Cr_3C_2 carbide in a Ni–Cr binder decomposed to lower carbides, and consumed Cr from the binder upon long-term exposure at elevated temperature. Two new coatings based on the $Cr_{23}C_6$ carbide were found to have excellent thermal stability, as well as excellent wear properties. (auth)

17725 REFRACTORY METAL CARBIDE COATINGS FOR LMFBR APPLICATIONS–A SYSTEMS APPROACH. Wolfla, T.A. (Union Carbide Corporation, Indianapolis, Indiana 46224); Johnson, R.N. J. Vac. Sci. Technol. 12: No. 4, 777-783 (July 1975).

Selection of existing coatings or the design of new coatings for wear

resistance in sodium-cooled nuclear reactors, particularly applications for core components, requires consideration of numerous unique criteria associated with this class of reactors. Wear resistance, low friction characteristics, and long-term, high-temperature chemical compatibility with the coolant and with the substrate are among the major concerns. Thermal transients in this high-temperature environment necessitate coatings with adequate thermal shock resistance. High neutron fluences require materials that are stable under irradiation and which do not transmute to undesirable elements. The selection, testing, and improvement of high-density, tightly bonded plasma and detonation- gun coatings designed to meet all of these criteria are described. The process descriptions include a review of the important developments in substrate surface preparation which are required to ensure strong bonding and to minimize interface contamination. Coating finishing techniques which were developed to optimize friction behavior are also described. The need for low-friction behavior has been an important requirement in the design of the coatings. Chromium-carbide coatings with a Ni–Cr binder applied with a detonation gun have been shown to possess acceptable friction, wear, and corrosion properties. Further enhancement of these properties was made through modification of the metallic binder particle size and the carbide binder ratio. The use of Inconel 718, Mo, and Tribaboy 700 binders were evaluated in an effort to improve the friction and self-welding characteristics as well as to improve the corrosion resistance in liquid Na. (auth)

17726 CERAMICS FOR NUCLEAR APPLICATIONS. Stoddard, S. D. pp 193-215 of Ceramic Engineering and Science. Frechette, V. D.; Pye, L. D.; Reed, J. S. (eds.). New York; Plenum Publishing Corporation (1974).

A review is presented of the various applications of ceramic materials in reactors (both fission and fusion) and other nuclear fields, including radioactive waste disposal. Emphasis is on applications in fission reactors: fuel, control elements, moderators, reflectors, shielding. (35 references) (DLC)

17727 OPTICAL INVESTIGATION OF TRANSIENT LAYERS IN MAGNETIC GARNET FILMS GROWN BY LIQUID PHASE EPITAXY. Henry, R. D.; Whitcomb, E. C. (Rockwell International, Anaheim, CA). Mater. Res. Bull.; 10: No. 7, 681-686 (Jul 1975).

The growth of garnet films using liquid phase epitaxy has led not only to materials with improved performance for bubble domain memories but to materials which exhibit improved microwave properties as well. The optical properties of such films were investigated and it was found that there exist transient layers at the substrate/film interface and at the film/air interface. The results and conclusions regarding the substrate/film interface do not agree with those of Davies et al. [Mater. Res. Bull. 10,65(1975)]. The discovery of a post growth lead-rich layer has not been previously reported and has important implications for both bubble domain and optical applications of garnet films. (auth)

17728 INTERFACE TRANSITIONS IN CZOCHRALSKI GROWTH OF GARNETS. Zydzik, G. (Bell Telephone Labs., Murray Hill, NJ). Mater. Res. Bull.; 10: No. 7, 701-707(Jul 1975).

A source of variation in boule diameter, that has not been previously described, has been observed to occur during automated or weight regulated pulling of garnets from the melt. The effects are related to refractive index variations observed in longitudinal cross section under polarized light. Solution at the tip of boule simultaneously with compensatory lateral growth higher on the crystal melt interface can take place under low temperature gradient conditions. This occurs when heat flow or radiation loss through the crystal is insufficient to preserve the initial, faceted or approximately conical, interface shape. (auth)

17729 EFFECT OF GRAIN SIZE ON HIGH-TEMPERATURE CREEP IN ZIRCONIUM CARBIDE. Dement'ev, L. N.; Zubarev, P. V.; Nezhevenko, L. B.; Groshev, V. I. Fiz. Metal. Metalloved.; 39: No. 3, 579-584(Mar 1975). (In Russian).

Creep was studied in zirconium carbide, ($ZrC_{0.99}$) at grain size from 6 to 45 μm, and temperatures from 2200 to 2700°C (0.70 to 0.85 T_{melt}) with loadings of 0.5 to 7.0 kg/mm^2. Creep occurred as a vacancy-diffusion process at low loads and as a dislocation-diffusion mechanism at high loads. The creep rate in the first case was indirectly proportional to the square of the grain size but at high loads it did not depend on the grain size. (tr-auth)

Metals and Alloys

Refer also to abstract 18944.

17730 (AEC-tr-7409) PHYSICO-CHEMISTRY OF RARE METALS. Tananaev, I. V. (ed.). May 1975. Translation of Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972. 328p. Dep. NTIS $10.60.

Twenty-six papers, including an invited paper by E. M. Savitskii, are included. Separate abstracts were prepared for 20 of the papers. A bibliography of the research of E. M. Savitskii is included. (DLC)

For abstracts of individual papers see: 17731–17734 and 17773–17788.

17731 (AEC-tr-7409, pp 99-112) RARE EARTH METALS AND ALLOYS. Terehova, V. F. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

A review is given of studies of the physico-chemical principles of the elaboration and application of the alloys of rare earth metals. (DLC)

17732 (AEC-tr-7409, pp 113-123) PHYSICAL METALLURGY OF THE SINGLE CRYSTALS OF HIGHLY-MELTING (REFRACTORY) AND RARE METALS AND ALLOYS. Burhanov, G. S. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

In order to differentiate between the real properties of metals and those affected by impurities and defects, pure and perfect monocrystals are needed. Crystal growth and properties of monocrystals of the refractory and rare metals and alloys are discussed. (DLC)

17733 (AEC-tr-7409, pp 245-248) USE OF THE ALLOYS OF RHENIUM METAL IN ELECTRO-VACUUM PRODUCTION. Iofis, N. A. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

The difficult requirements for a thermionic emitter (cathodic joint) in electro-vacuum and electronic instruments are pointed out. A nickel chrome alloy containing ~10% Re has an increased high-temperature rigidity and a decreased evaporation rate of the cathode. Addition of Re to the tungsten used in the heaters also results in improved stability towards recrystallization and raised firing temperatures and times. (DLC)

17734 (AEC-tr-7409, pp 259-271) USE OF CERIUM IN HIGH-STRENGTH CAST IRON FOR THE PRODUCTION OF CAST CRANK SHAFTS FOR TRACTOR ENGINES. Zvolinskaja, V. V. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Forged steel crankshafts are being replaced by castings from high-strength pig iron. Advantages of Ce over Mg as a modifier for cast iron are pointed out. Properties of the resulting crankshafts are analyzed, particularly the wear resistance. (DLC)

17735 (BNWL-1535) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, OCTOBER 1970, DIVISION OF PRODUCTION AND HANFORD PLANT ASSISTANCE PROGRAMS. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1970. Contract At(45-1)-1830. 55p. Dep. NTIS $5.75.

Declassified 21 Jun 1973.

Assistance to Douglas United Nuclear is reported in the following areas: low temperature zircaloy hydriding, N-reactor decontamination, meteorological studies, heat transfer study of Mark IV fuel, N-reactor fuel temperature following primary system rupture, and fuel meltdown studies. Assistance to Atlantic Richfield Hanford Company is reported for plutonium reclamation facility (PRF) dissolver overflow analysis, neptunium chemistry in the Purex Extraction (HA) column, environmental and regulatory technology, waste management, testing flowsheets for U(IV) as plutonium reductant, platinum catalyzed reduction of Uranium (VI) to Uranium (IV), radiological hazards from stored P wastes and process technology. Assistance to the Hanford Plant is described for radiation protection, environmental evaluations, dosimetry technology, Columbia River studies, and temperature tolerance of aquatic insects and crayfish. (MCW)

17736 (CONF-7210131-P2) PREPARATION AND PROPERTIES OF TITANIUM ALLOYS FOR AIRCRAFT APPLICATIONS. Proceedings of the 3rd Internal Colloquium of the Material Science Institute II, Erlangen, West Germany, October 11–12, 1972. Part 2. Creep Behavior. Thermal Stability. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet). 1972. 85p. (In German).

Four papers are included in this volume: time-state strength and stress dependence of creep; use of fracture mechanics for study of stress corrosion sensitivity of Ti alloys; creep and thermal stability of TiAl6V4 and TiAl6Sn2 with an without seawater corrosion; and influence of shaping and heat treatment on creep of TiAl6V4. Separate abstracts were prepared for the last two papers. (DLC)

For abstracts of individual papers see: 17743 and 17791.

17737 (RDT-M-7-7T(4-75)) COBALT–CHROMIUM ALLOY BARS AND SHAPES. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Apr 1975. 10p. RSO.

This standard covers hot rolled, solution annealed, and aged Co–Cr alloy bars in shape of rounds, squares, hexagons, and hollow cylinders for wear and corrosion-resistant applications (non-tensile load bearing) in nuclear plants. The composition includes 28-32% Cr and 3.5 to 5.5% W. (DLC)

17738 BORON: OUT OF THE SKY AND ONTO THE GROUND. Kuehl, D. K. (Composite Materials Corp., Broad Brook, CT). pp 67-71 of Technology in Transition. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 20th national sample symposium and exhibition; San Diego California, USA (29 Apr 1975). See CONF-750459-.

Now an accepted, engineered material for aerospace applications, boron is taking its place on the ground. Both current production applications, prototype (development) applications, and speculative applications abound. In the leisure product market, boron epoxy or boron aluminum has been used or tried in golf clubs (in combination with graphite epoxy or to reinforce aluminum or steel), in tennis racquets, in bicycles, racing shells, skis and skipoles, bows and arrows, and others. In the industrial area, boron has been used to reduce fatigue, increase stiffness, or for its abrasive properties. Textile machinery, honing tools, and cut off wheels or saws are among the applications. In the medical field, prosthetics and orthotic braces, wheel chairs, canes, and crutches are all good applications for boron. Applications for boron in transportation, construction, and heavy industry are also possible. The volume of boron used in these applications could have a major impact on prices, making boron composite parts cost competitive with conventional materials. (auth)

17739 BORON/ALUMINUM SHELF FOR SHUTTLE ORBITER. Liskay, G. G.; Brownfield, C. D. (Rockwell International, Downey, CA). pp 181-192 of Technology in Transition. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 20th national sample symposium and exhibition; San Diego, California, USA (29 Apr 1975). See CONF-750459-.

Boron/aluminum skins and channels were used in the fabrication of a prototype honeycomb sandwich avionics shelf. The avionic shelves are stiffness-critical and must be vibration tolerant. In conjunction with the shelf mounting system, they must isolate the avionics equipment from the severe vibration of the primary and secondary structure nearby. Design rationale, fabrication procedures, vibration test criteria and test results are presented. (9 fig) (auth)

17740 MANUFACTURING PROCESSES FOR INCONEL 718 MISSILE STRUCTURE. Mayor, R. A.; Moore, F. C.; George, H. C. (Martin Marietta Aerospace, Orlando, FL). pp 402-410 of Technology in Transition. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 20th national sample symposium and exhibition; San Diego, California, USA (29 Apr 1975). See CONF-750459-.

Martin Marietta Aerospace has built a prototype fuel tank/subsonic air duct entirely of Inconel 718. The uniqueness of this program lies in the forming, welding, machining, and heat-treating of complex missile structures. Manufacturing processes include drop hammer forming, electrical discharge machining (EDM), forging, manual GTAW welding, and conventional machining. The weldability and weld efficiency of Inconel alloys 718 and 706 were demonstrated through an in-house program. (auth)

17741 CREEP, VISCOELASTICITY, AND CREEP FRACTURE IN SOLIDS. Gittus, J. London; Applied Science Publishers Ltd. (1975). 715p.

The subject is reviewed in chapters entitled: deformation mechanisms (including a reference to irradiation creep); diffusion creep (including a section on non-stoichiometric UO_2); dislocation creep in metals; dislocation creep in non-metals (including UO_2, CeO_2, UC); irradiation-induced deformation; deformation maps (including a section on maps for irradiation creep); viscoelastic models; viscoelasticity in metals; viscoelasticity in non-metals; metals and alloys of high creep strength (including materials of importance in nuclear technology); superplasticity (including Pu, U, and other materials of importance in nuclear technology); fracture (including a section on irradiation effects); effects of the environment (including solid metals in liquid metals); the mechanical equation of state. The chapters on dislocation creep in non-metals, irradiation-induced deformation, metals and alloys of high creep strength, and superplasticity, are in NSA scope and separate abstracts have been prepared for them. (UK)

For abstracts of individual papers see: 17696, 17742, 17825, and 17865.

17742 METALS AND ALLOYS OF HIGH CREEP STRENGTH. Gittus, J. (United Kingdom Atomic Energy Authority, Salwick, Eng.). pp 447-508 of Creep, Viscoelasticity, and Creep Fracture in Solids. Gittus, J. (ed.). London; Applied Science Publishers (1975).

It is pointed out that nuclear fuel elements are among the engineering structures that are fabricated out of metallic alloys of high creep resistance. The section headings of the review include the following: basic sources of creep strength in metallic alloys; deformation maps; ferritic steels; nimonic and related alloys; directional solidification, intermetallic compounds; thermomechanical processing; dispersion strengthening; fiber reinforcement; refractory metals (tungsten, rhenium, tantalum, molybdenum, niobium, zirconium and vanadium and their alloys). (UK)

Corrosion and Erosion

Refer also to abstracts 16802 and 18958.

17743 (CONF-7210131-P2, pp VI/1-VI/22) CREEP BEHAVIOR AND THERMAL STABILITY OF TiAl6V4 AND TiAl6Sn2 ALLOYS WITH AND WITHOUT SEAWATER CORROSION. Hillnhagen, E. (Krupp Forschunginstitut, Essen, Ger.); Wirth, G. 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II, Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet.

The effect of salt water on the embrittlement of TiAl6V4 and TiAl6V6Sn2 alloys was studied in the range from room temperature to 450°C, using rods, sheets and weldments with globular and lamellar structure. About 700 creep tests were carried out at several cooperating institutes. The composition and homogeneity of the test specimens, prepared below the transition temperature, were carefully determined. The conditions were selected as to yield information on the usability of these materials in maritime climates. Notched and unnotched specimens were tested with and without the presence of sea water under load at room temperature and at 90, 300, and 450°C for periods up to 2000 hours. No damaging effect of the sea water was observed up to 150°C; from 300°C the creep strength decreased and embrittlement was noted. Without exposure to sea water both alloys performed satisfactorily. Welding caused a reduction of the creep strength up to 300°C; this could be eliminated by subsequent heat treatment. Tests with notched rods did not yield unambiguous results. (TTT)

17744 (CONF-7210131-P4) PREPARATION AND PROPERTIES OF TITANIUM ALLOYS FOR AIRCRAFT APPLICATIONS. Proceedings of the 3rd Internal Colloquium of the Material Science Institute II, Erlangen, West Germany, October 11–12, 1972. Part 4. Corrosion. Oxidation. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet). 1972. 105p. (In German).

The five papers in this volume are on: stress corrosion (SC) of Ti industrial materials, SC of Ti alloys in gaseous HCl and its relation to hot salt corrosion, repassivation of TiAl6V4 in sodium halides, effects of moisture on salt corrosion of Ti alloys, and formation of surface layers on Ti alloys. Separate abstracts were prepared for the last 3 papers. (DLC)

For abstracts of individual papers see: 17745–17747.

17745 (CONF-7210131-P4, pp XIII/1-XIII/13) REPASSIVATION BEHAVIOR OF TiAl6V4 IN SODIUM HALOGENIDES. Buhl, H. (Deutsche Forschubgs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz-Wahn, Ger.). 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II; Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet).

The condition of repassivation, which is of great interest for determining the tendency toward stress corrosion, was studied on activated specimens of TiAl6V4 alloy for times of 1 millisecond to 20 seconds after activation by means of potentiometric measurements in Na halide solutions of varying concentrations against a 3.5 N Ag/AgCl electrode. Results indicated that a dissolution–precitation mechanism is involved in the repassivation. During the dissolution period of 9 to 600 milliseconds, the interface remains active and is affected by the type and the concentration of the anion. Precipitation of an as yet undetermined reaction product terminates the state of activity of the Ti surface, initiating the growth of the passive layer. In an 1N electrolyte, the growth follows the inverse logarithmic law; deviations are noted in more dilute solutions. No influence of the dissolved

atmospheric oxygen within the time interval studied could be established. In water-free methanol the material remained active through the period. (TTT)

17746 (CONF-7210131-P4, pp XIV/1-XIV/14) EFFECT OF THE WATER CONTENT OF THE ATMOSPHERE IN THE SALT CORROSION OF TITANIUM ALLOYS BETWEEN 300 and 500°C. Weidemann, R. (Metallgesellschaft AG, Frankfurt am Main). 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II; Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet).

High-temperature stress corrosion under a layer of salt is an important factor in determining the applicability of Ti alloys for use in aircraft jet engines; therefore, the role of one of the main variables, the moisture content of the air, was investigated. Rods having lamellar or globular structure, made of TiAl6V4 alloy were used for creep tests under a layer of salt. The layer was formed by the immersion and subsequent drying of the test specimens into synthetic sea water with a threefold concentration. The stress corrosion testing was carried out at 450°C in a horizontal furnace; the desired moisture content was established by directing the air stream over a water bath. The exposures ranged from 20 to over 500 hours. It was found that moderate water content induces a tendency toward stress corrosion at high temperature; very low water concentrations resulted in extended periods without fracture. Similar results were obtained when the atmosphere had a very high moisture content. The structure of the alloy did not exert any effect on the results. The inhibiting effect of high moisture contents cannot be easily explained. The critical range is similar to the usual moisture content of rooms: about 60% relative humidity at 20°C. (TTT)

17747 (CONF-7210131-P4, pp XVI/1-XVI/11) FORMATION OF SURFACE LAYERS IN INDUSTRIAL TITANIUM ALLOYS. Ruedinger, K.; Weigand, H. H. 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II; Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet).

Ti and its alloys cannot be used at temperatures above 550°C because of the reduction of their creep strength at higher temperatures; no information is available on the formation of surface layers. In order to obtain such data, unalloyed Ti and several Ti alloys, such as Ti–5Al–2.5 Sn, $\alpha + \beta$ alloys with and without Al, and the β alloy Ti–13V–11Cr–3Al were exposed to high temperatures up to 1000°C in air for periods up to 250 hours to study the influence of the structure and of the alloying elements on the formation of the surface layer. The hardness measurements were used to determine the penetration of oxygen; the uptake of nitrogen was negligible. The hardness data indicated that Ti takes up more oxygen and allows it to diffuse to a larger extent than the Ti alloys. This agreed with the corresponding weight gain data. Exposure to high temperature induced structural changes and created concentration gradients in the specimens. Al exerted a protective effect as it was found to migrate alone to the area of highest oxygen supply; the Al_2O_3 formed is incorporated into the layer and serves as a barrier against further diffusion of O. (TTT)

17748 (GEAP-14029-2) STEAM GENERATOR MATERIALS ENGINEERING SECOND QUARTERLY REPORT, OCTOBER–DECEMBER 1974. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). 1974. Contract AT(04-3)-893. 49p. AT.

Major accomplishments were: the topical report "Stress Corrosion Studies of LMFBR Steam Generator Materials," GEAP-12536, was issued. Stress corrosion testing of 2¼ Cr–1Mo tubing in faulted superheat environments was completed. Fabrication of the IHTS simulation (Loop B) components is 70% complete, and the remaining items are in the final stages of welding or inspection. A support platform for Loop B was erected to accept the assembly of available components. Loop 1R was run for 450 hours; this initiated particulate thermal degradation studies. (18 figs, 11 tables) (auth)

17749 (ORNL-tr-2987) EFFECT OF COLD-WORKING ON STEAM CORROSION (550°C, 70 atm) OF FIVE FERRITIC STEELS WITH DIFFERENT CHROMIUM CONTENTS. Leistikow, S.; Thenen, A. v.; Pott, E. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Feb 1975. Translation by R. G. Mansfield of KFK-2120. 61p. Dep. NTIS $6.25.

Five different ferritic chromium steels were tested at 550°, 70 atm, in superheated steam to evaluate how steam corrosion depends on chromium content (0.8–18.7 percent) and the amount of cold work (0–90 percent). Oxidation kinetics and oxide morphology were examined by gravimetric, metallographic, and microanalytical methods. Results showed for all alloys (greater than or equal to 6.7 percent Cr)–in addition to the known effect of higher corrosion resistance by increasing chromium content–an increasing corrosion resistance with increasing cold work. A gain of 70–75 percent (related to the metal loss of the undeformed material) was found after 1000-h exposure in case of 80 percent cold-deformed alloys containing more than 11 percent Cr. The relationship between corrosion, chromium content, and cold deformation was approximated by a negative exponential function. Microanalysis revealed high-Cr local areas of the highly deformed oxidized 18.7 percent Cr alloy. The effect of the bulk deforming pretreatments upon corrosion rate is explained by improved diffusivity of Cr in the defect structure, preferential oxidation, and formation of a solid solution (FeFe/sub 2-x/Cr/sub x/O_4) of spinel type as oxide subscale. Protective scales with low defect concentrations and reduced ion diffusivity were formed which are controlling the corrosion reaction. Thus, especially in case of highly deformed materials with medium chromium content the oxidation changed over from a parabolic to a logarithmic rate law. The experiment showed that corrosion of ferritic steels with medium chromium content can be predicted if the Cr content as well as the cold deforming pretreatment are taken into account. (auth)

17750 (TI-759-260-001) STABILITY OF BERYLLIUM IN NaK. Van Houten, R. (Atomics International Div., Canoga Park, Calif. (USA)). 21 Sep 1970. 19p. Dep. NTIS $4.00.

The successful long-time use (30–40,000 hours) of Be in high-temperature NaK (nominal 1200°F) depends on: a) the effects of even trace quantities of oxygen on Be corrosion; b) Be erosion by classic mass transfer, and c) possible negative consequences associated with the formation of brittle phases resulting from contact of Be (direct or by deposition) with many of the materials in the reactor/heat exchanger loop. (52 references) (auth)

17751 (WARD-NA-3045-23) RELATIONSHIPS FOR CORROSION OF TYPE 316 STAINLESS STEEL IN LIQUID SODIUM. Bagnall, C.; Jacobs, D. C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). May 1975. Contract E(11-1)-3045. 41p. AT.

A systematic statistical review of sodium corrosion data for Type 316 stainless steel has resulted in the formulation of two expressions which describe behavior of the material as a function of temperature, oxygen content, and velocity. One expression incorporates the velocity-dependent regimen where sodium flow is less than 10 fps, while the other, embracing the majority of experimental data, covers the velocity-independent range above 10 fps. The effects of radiation, high heat flux, axial temperature gradient (dT/dL), and the downstream factor have not been included in the analysis; these omissions were largely due to insufficient data or inadequate experimental detail. However, a discussion of some preliminary evidence of enhanced corrosion due to a high dT/dL environment is given. Potential effects on downstream corrosion in an isothermal zone are illustrated and the impact this is likely to have in the reactor is outlined. For reference purposes, a comprehensive appendix includes reviews of individual experiments used in the statistical analysis. (auth)

17752 INVESTIGATION OF THE SURFACE DIFFUSION OF SILICON AND ALUMINUM OXIDE ON MOLYBDENUM BY MEANS OF FIELD EMISSION MICROSCOPE. Bobev, K.; Gaidarova, V. (Central Lab. for Agrophysical Researches, Sofia). Compt. Rend. Acad. Bulg. Sci.; 28: No. 1, 87-90(1975).

Results show that SiO and Al_2O_3 adsorbates on Mo surfaces decrease the emission current. These adsorbates have distinct dielectric properties, altering the potential barrier width at the metal/dielectric/vacuum boundary. For thicker coatings, emission probably occurs from the adsorbate layer, and the potential barrier height may be changed. (DLC)

17753 DISSOLUTION OF ZIRCONIUM IN AQUEOUS SOLUTIONS OF AMMONIUM FLUORIDE AND HYDROFLUORIC ACID. Morozumi, T.; Moriya, M.; Kubo, T. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). Hokkaido Daigaku Kogakubu Kenkyu Hokoku; No. 72, 133-144(Sep 1974). (In Japanese).

The dissolution rate and the corrosion potential of zirconium were measured in aqueous solutions of ammonium fluoride and hydrofluoric acid at 30°C. The dissolution was rapid and uniform in both solutions, and the rate increased remarkably with the increase in concentrations of the solutions. In the case of ammonium fluoride solution, the pH of the solution also showed an influence on the dissolution rate. The dissolution rate may be closely connected with the concentration of hydrogen fluoride existing in the form of neutral molecules in the solutions. In a thermodynamical sense, the depassivation by fluorides may be attributed to the formation of soluble fluoro-zirconium complexes. However, in order to explain the highly aggressive attack of

fluorides on zirconium, certain dissolution mechanisms, in which the molecular HF or other fluoro-compounds can take a share of their contribution, must be assumed. (auth)

17754 FUNDAMENTALS AND FORMS OF HIGH-TEMPERATURE CORROSION. Leistikow, S. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). VDI (Ver. Dtsch. Ing.) Ber.; No. 235, 125-143(1975). (In German).

From meeting on the behavior of mechanically stressed materials and components under corrosion; Lindau, F. R. Germany (17 Apr 1975). 23 figs.; 17 refs.

A few general remarks on the thermodynamic aspects of the oxidation of metals are followed by a discussion of the kinetics of high temperature corrosion reactions. Influential parameters, the oxidation behavior of important high temperature alloy base materials and high temperature alloys, and corrosive attacks of some gases are discussed. (GE)

17755 POLARIZATION AND PHOTOPOTENTIALS OF InSb IN NaOH. Patterson, R. E.; Chance, D. A.; Nobe, K. (Univ. of California, Los Angeles). Corrosion; 31: No. 7, 243-246(Jul 1975).

The anodic dissolution of the (111)-Sb surface in 1N NaOH was at a slightly higher rate compared with the (111)-In surface. On the other hand, the rate of hydrogen evolution was slightly higher on (111)-In than on (111)-Sb. Anodic dissolution was not affected by illumination prior to passivation. However, photopotentials as high as 0.1 V were observed after the InSb was anodized at passivating currents. The magnitude of the photopotentials decreased during the potential decay after anodization was completed. The spectral response of the photopotentials after attainment of steady state corrosion potentials was determined. The differential capacitance at the corrosion potential prior to anodization was 35 mu F/cm^2. Immediately after anodization, the capacitance was 0.6 mu F/cm^2 and then increased to about 2.2 mu F/cm^2 at the end of the potential decay. Both the photopotentials and small capacitance values were due to the film formed during anodization. (auth)

Preparation and Fabrication

Refer also to abstracts 18929 and 19020.

17756 (NAA-SR-Memo-12359) OXIDATION OF INCOLOY 800 IN WET HYDROGEN. Stearns, J. D. (Atomics International Div., Canoga Park, Calif. (USA)). 6 Mar 1967. 5p. Dep. NTIS $4.00.

Declassified 6 Oct 1972.

It has been established experimentally that in order for the SCB-1 coating (hydrogen diffusion barrier) to adhere to Incoloy 800, the material must be oxidized prior to or during firing of the coating to provide a surface which the coating will wet. An investigation was conducted to determine if pre-oxidation in wet hydrogen offered any advantages over oxidation in air. Visual examination of the oxide formed in wet hydrogen revealed an adherent dark gray-green appearance. X-ray fluorescence analysis indicated higher Ni and Fe concentrations in the oxide formed in wet hydrogen. Flexure tests on coated specimens did not reveal any improvement in adherence of coating over that of specimens oxidized in air. (auth)

17757 (RDT-M-1-6T(4-75)) MILD STEEL ELECTRODES FOR GAS METAL-ARC WELDING (ASME SFA-5.18 WITH ADDITIONAL REQUIREMENTS). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Apr 1975. 8p. RSO.

This standard covers mild steel electrodes for gas metal-arc welding for nuclear and associated applications. (DLC)

17758 (REG/G-3.29(5-75)) PREHEAT AND INTERPASS TEMPERATURE CONTROL FOR THE WELDING OF LOW-ALLOY STEEL FOR USE IN FUEL REPROCESSING PLANTS AND IN PLUTONIUM PROCESSING AND FUEL FABRICATION PLANTS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). May 1975. 3p. NRC.

The regulatory guide provides that weld fabrication for low-alloy steel components important to safety should comply with acceptable fabrication requirements and should be performed by qualified welders and welding procedures in accordance with the requirements of Section IX of the ASME Code supplemented by the following: 1. The procedure qualification should require that: a. A minimum preheat and a maximum interpass temperature be specified. b. The welding procedure be qualified at the minimum preheat temperature. 2. For production welds, the preheat temperature should be maintained until a postweld heat treatment has been performed. 3. Production welding should be monitored to verify that the limits on preheat and interpass temperatures are maintained. 4. In the event that regulatory positions C.1, C.2, and C.3 above are not met, the weld is subject to rejection. However, the soundness of the weld may be verified by an acceptable examination procedure. (auth)

17759 (SAND-74-0377) PARALLEL GAP WELDING TO THICK FILM METALLIZATION. Johnson, D. R.; Knutson, R. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Apr 1975. Contract AT(29-1)-789. 41p. Dep. NTIS $5.25.

The study was directed at the parallel gap welding response of a series of gold and platinum-gold thick film conductor materials that were subjected to variable peak temperature/belt speed firing profiles. These thick film materials, all fritted, included two pure golds (DuPont EX8760 and ESL 8831) and four platinum-golds (DuPont 8653, DuPont 8895, Cermalloy 4100, and Cermalloy 4120). Upon printing and drying according to each manufacturer's recommendations, the weld test patterns were fired at peak temperatures of 800, 850, 900, or 950°C with belt speeds of 0.4, 0.6, or 0.8 millimeters per second. Parallel gap welding was conducted using a repeating series of weld voltage/pulse duration settings and a nominal 0.05 millimeter thick by 0.38 millimeter wide pure gold ribbon. Evaluation of the welds was determined through a 90° peel test. Conclusions are presented. (auth)

17760 BERYLLIUM FABRICATION TECHNIQUES AND THEIR RELATED APPLICATIONS. Grant, L. A.; Kamper, L. F. (Grant and Kamper, Inc., San Diego, CA). pp 453-466 of Technology in Transition. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 20th national sample symposium and exhibition; San Diego, California, USA (29 Apr 1975). See CONF-750459-.

Several recently fabricated space structures are reviewed which employ high strength wrought beryllium sheet. Physical hardware produced involving long (84") beryllium booms, ultra lightweight, hermetic tight camera housings and honeycomb instrument panels are discussed. Other selected hardware is reviewed showing basic design options of end fittings, close outs and hermetic seals between beryllium and non-beryllium components. (32 fig) (auth)

17761 EFFECT OF TEMPERATURE ON THE LATHE MACHINING CHARACTERISTICS OF ANNEALED Ti-6Al-4V. Rennhack, E. H.; Carlsted, N. D. (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA). pp 467-477 of Technology in Transition. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 20th national sample symposium and exhibition; San Diego, California, USA (29 Apr 1975). See CONF-750459-.

The subzero and elevated temperature lathe machining characteristics of annealed Ti-6Al-4V were explored as a function of cutting depth and speed at a constant axial feed rate of 0.010 in./rev. Machinability was assessed in terms of tool forces, induced residual stress, finish, and surface damage using a lathe dynamometer, a ring-deflection technique, surface roughness measurements, and metallographic analysis, respectively. An evaluation of the interrelated effects of the machining variables on deformation behavior is presented and compared with that for room temperature machining. (6 fig) (auth)

17762 PROCESSING AND CHARACTERIZATION OF SEVERAL TUNGSTEN ALLOYS. Hall, R. C. (Martin Marietta Aerospace, Orlando, FL); Ossin, A.; Ammon, R. L.; Buckman, R. W.; Aronin, L. pp 490-502 of Technology in Transition. Azusa, CA; Society for the Advancement of Material and Process Engineering (1975).

From 20th national sample symposium and exhibition; San Diego, California, USA (29 Apr 1975). See CONF-750459-.

Several tungsten alloys (W-2 percent ThO_2, W-0.35 percent HfC, W-4 percent Re-0.35 percent HfC, and W-10 percent Cu) were processed by different techniques to billet $^3/_4$ inch by $1^1/_8$ inch to evaluate the production feasibility and the properties of such material intended for air vane leading edges on high-speed missiles. The starting materials and the final products were characterized chemically and metallographically. Processing techniques and problems are described. Tensile strength and thermal expansion to temperatures as high as 5000°F were measured. (10 fig, 7 tables) (auth)

17763 ELECTRODEPOSITION OF CADMIUM: TIN ALLOY FROM A SULFURIC ACID ELECTROLYTE. Tyutina, K. M.; Kosmodamianskaya, L. V.; Kudryavtsev, N. T. (Moscow Chemical-Technological Inst.). Prot. Met.; 10: No. 5, 549-551(1974).

Translated from Zashch. Metal.; 10: No. 5, 599-601(1974).

The effects electrolyte components, current density, and temperature on composition and quality of electrodeposited Cd-Sn alloys were investigated. The optimum recommended electrolyte contains (all values in grams per liter) $CdSO_4 \cdot 8/3H_2O$ 120 to 150, $SnSO_4$ 17.5 to 20, H_2SO_4 80 to 100, Cd-Sn alloy 2.0, and tetraethyl ammonium iodide 0.26 to 1.0. The optimum temperature is 18 to 25°C and the cathodic current density 1.0 to 3.0 A/dm^2. The cur-

rent yield is 99 to 100%; the anodes are of Cd–Sn alloy (25 to 30% Sn). (JRD)

17764 ELECTROPOLISHING OF T-111 FOILS FOR TRANSMISSION ELECTRON MICROSCOPY. Zielinski, R. E. (Mound Lab., Miamisburg, OH). J. Less-Common Met.; 40: No. 3, 341-343(May 1975).

Details of electropolishing T-111 specimens using a twin-jet unit and a one-step procedure are given. The electrolyte was maintained at room temperature, the applied potential was 15 V, the current was 90 mA, and the current density was 16A cm^{-2}. Micrographs of the polished specimens are included. (JRD)

17765 METHOD OF CONSTRUCTING A NUCLEAR FUEL TUBE. Seki, N. (to Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)). Japanese Patent 1974-5158/B/. 11 Jun 1970. 2p. (In Japanese).

The invention pertains to a method of constructing an effective nuclear fuel tube composed of vanadium for use in fast breeder reactors. Vanadium with a purity of up to 99.5% is hard and brittle, and therefore fuel tubes cannot be constructed by ordinary methods. The object of the invention is to provide a process making the industrial production of vanadium fuel tubes possible. It is characterized by choosing, as a cathode, a thin-walled tube of nickel-chrome stainless steel and, in a vanadium chloride mixture, with vanadium as an anode, evacuating the air and conducting electrolysis in the presence of an inert gas, thereby depositing vanadium onto the outer surface of the thin-walled cathodic tube, followed by a shaping and working process which provides the desired fuel tube. For example, a tube of AISI 316 as a cathode, and a fused electrolytic bath composed mainly of vanadium chloride, can be employed. Then, a cathode of nickel-chrome stainless steel is inserted concentrically within an anode comprised of a double-walled mesh tube of 99.5% V packed with 99.5% V particulate. Air is withdrawn, He admitted and, after raising the temperature to 650°C, electrolysis is conducted, depositing 99.9% V. Thereafter, by extracting, extruding or swage processing, the plated tube is shaped into the desired dimensions. (JA)

17766 STRUCTURAL MATERIALS FOR NUCLEAR REACTORS, TODAY. Mishima, Y. (Tokyo Univ. (Japan). Faculty of Engineering). Nippon Kikai Gakkaishi; 77: No. 666, 541-547 (May 1974). (In Japanese).

All kinds of solid metallic structural materials except fuel cores are covered in the review. One aspect of the review pertains to the utilization conditions of reactor materials, which can be classified into four conditions: (1) temperature, (2) stress, (3) the conditions under which the chemical reaction with environment is important, and (4) irradiation. The selection of alloys varies with environmental temperature, because the diffusion of general industrial metals begins above the absolute temperature of about a half of their melting point T_m. The reaction of coolant and nuclear fuel with alloys is a problem. The irradiation change of materials other than nuclear fuel is discussed. Materials having a considerably high ratio of yield point to tensile strength have been found. Brittleness transition temperatures (NDT) do not show a clear narrow range. Design must take creep into consideration. The fourth is anisotropy. The main structural materials being used for nuclear reactors at present are described individually. (JA)

17767 FIELD ANNEALING WORKS OF THE WELDED PARTS OF PIPINGS IN A NUCLEAR POWER PLANT. Misaka, T. (Kehin Construction Co. Ltd., Tokyo (Japan)). Haikan Gijutsu; 16: No. 6, 131-132, 149-155(May 1974). (In Japanese).

Field annealing works are performed according to Ordinance No. 28 of the Ministry of International Trade and Industry. Temperature recorders are of the JIS 0,5 class, and can be used from 0°C to 1200°C. The temperature recorders are calibrated twice in a year with a potentiometer of accuracy 0,01 class. As temperature sensor, alumel-chromel type thermocouples are used. The thermocouples are inspected by sampling method, and only those that pass inspection can be utilized. When field local annealing is performed, the range of heating is an important subject. Heating equipment is inevitably placed near the piping system. Therefore it is very important to decide on the best position of the heating equipment. Since the field annealing work is likely to be prolonged, it is desirable to secure an exclusive power source for heating units. In the future, the plan to shorten the field annealing work in nuclear power plants must be established, for the annealing work in nuclear power plants require about three times as much time as that in thermal power plants. (JA)

17768 ULTRA-PURE ALUMINIUM AS CONDUCTOR MATERIAL IN CRYOMAGNETS. Schauer, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). KFK-Nachr.; 7: No. 1, 28-32(1975). (In German).

7 figs.; 10 refs.

The magnetoresistance of polycrystalline aluminium bands (diameter: 6 mm × 0,3 mm) is investigated in dependence of material purity, magnetic field ($0 \leq B \leq 4$ Tesla), and temperature ($4,2\ K \leq T \leq 32\ K$). The experimental apparatus is described, and the measured values are presented in a graph. These values provide the basis for optimization of the loss behavior of a cryomagnet. (GE)

17769 DEPOSITION RATE AND SUBSTRATE TEMPERATURE EFFECTS ON THE STRUCTURE AND PROPERTIES OF BULK-SPUTTERED OFHC Cu AND Cu–0.15 Zr. Hecht, R.J.; Mullaly, J.R. (Pratt and Whitney Aircraft, Florida Research and Development Center, West Palm Beach, Florida 33402). J. Vac. Sci. Technol. 12: No. 4, 836-841 (July 1975).

Deposition rate and substrate temperature were observed to affect the structure and properties of thick, sputtered OFHC copper and Cu–0.15 Zr deposits. Deposition of OFHC Cu and Cu–0.15 Zr was performed by high-rate sputtering from a cylindrical (hollow) cathode. Bulk deposits varying from 250 to 3700 μ thicknesses were evaluated as to microstructure, surface topography, and fractography. At conditions of low substrate temperature, crystallite size and openness of the structure increased with increasing deposition rate for both materials. At elevated temperatures it was possible to produce an equiaxed, ductile structure of OFHC Cu, but only at low deposition rates. At higher deposition rates open structures resulted having recrystallized, equiaxed grains within large, poorly bonded crystallites. Sputtered Cu–0.15 Zr deposited at basically equivalent conditions, as used for OFHC Cu, exhibited open-type structures for all conditions evaluated. However, lower deposition rates significantly reduced the openness of the structure, as did increasing substrate temperature. The use of a triode discharge to achieve a higher degree of ion bombardment in biasing was effective in generating a dense, non-voided structure of Cu–0.15 Zr. (auth)

17770 BELL-JAR RF SPUTTERING SYSTEM. Rock, F.C.; Smith, C.W. (Department of Physics and Astronomy, University of Maine, Orono, Maine 04473). J. Vac. Sci. Technol. 12: No. 4, 943-945 (July 1975).

The general design criteria of rf sputtering systems are considered in an attempt to overcome past difficulties encountered with large, matching network-to-target distances and the use of small-diameter targets. The interest here is flexibility and high deposition rate for relatively low rf power. The design of a matching network and target assembly suitable for use in a conventional bell-jar vacuum system is presented. Results for niobium show that a deposition rate of 1100 Å/min could be realized using only 440 W of rf power. (auth)

17771 FILM-THICKNESS RESISTANCE MONITOR FOR DYNAMIC CONTROL OF VACUUM-DEPOSITED FILMS. Provo, J.L. (General Electric Company, Neutron Devices Department, P.O. Box 11508, St. Petersburg, Florida 33733). J. Vac. Sci. Technol. 12: No. 4, 946-952 (July 1975).

A simple, inexpensive film-thickness monitor has been developed which accurately and independently determines the thickness of a film at any time during a deposition process. The principle of operation is the change in resistance of a vacuum-deposited film on a polished sapphire substrate maintained at a constant deposition temperature. The device, which is easily calibrated and automated, was found to have routine application to many types of metal film depositions in production and the development laboratory. The relationship between film deposition thickness and measured conductance was found to be linear for metal films over a wide range of thickness at constant substrate temperatures, from room temperature to 600°C. Data is presented which compares film thickness, as measured by interferometric and differential weighing techniques, with that predicted from resistance measurements. The monitor has been used for following changes in resistance during *in situ*, reactive, and air-exposed hydriding and for resistivity determinations of occluder film hydrides of erbium, scandium, and titanium. (auth)

17772 EFFECT OF PLATING CURRENT DENSITY ON PROPERTIES OF TITANIUM–CADMIUM DEPOSIT. Altura, D. (Rockwell International, Los Angeles); Mansfeld, F. Corrosion; 31: No. 7, 234-236(Jul 1975).

Titanium-cadmium plating was evaluated at various plating current densities which may be encountered in industrial practice. Both high and low current densities resulted in increased hydrogen embrittlement tendency over the optimal plating condition. Deleting the current strike had no noticeable effect on embrittlement behavior. Results of salt spray testing indicated that gross corrosion behavior was independent of plating current density. The corrosion behavior of cadmium-plated steel coupled to aluminum alloys was both a function of plating current density and the type of aluminum alloy used. Plate microstructure was a strong function of plating current density. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 16897, 18488, 18841, 18845, 18926, 19000, 19024, and 19060.

17773 (AEC-tr-7409, pp 63-78) POLYMORPHISM OF METALS. Terehova, V. F. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

About 32 polymorphic metals exist, including many rare earths and actinides. Various groups are discussed in detail: rare earths; Ti, Zr, and Hf; Sn; U and transuranic elements; and Fe, Co, and Mn. Mechanism and kinetics of the polymorphic transformation is also discussed. (8 fig., 1 table, 19 references) (DLC)

17774 (AEC-tr-7409, pp 85-99) ALLOYS OF RHENIUM. Tylkina, M. A. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

This review discusses the physical metallurgy of various classes of Re alloys: alloys with trancition metals in groups IV to VIII, alloys with W and Mo, alloys with Ni, and alloys with Ni and Cr. Heat treatments, some properties, and service applications are also covered. (DLC)

17775 (AEC-tr-7409, pp 124-135) SUPERCONDUCTING ALLOYS OF NIOBIUM AND VANADIUM. Baron, V. V. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Properties of alloys of Nb and V with elements of groups I to VIII are reviewed. Phase diagrams and composition–T_c diagrams are covered. (DLC)

17776 (AEC-tr-7409, pp 135-140) ALLOYS OF TANTALUM. Cyganova, I. A.; Tylkina, M. A. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

An account is given of studies on the effect of purity and alloying on the properties of Ta. It is shown that many alloying metals retard the recrystallization in Ta; W also raises the melting point. The mechanical properties (hardness, tensile strength, etc.) are also increased by alloying. Changes in resistivity, thermal expansion, and emissivity with alloying are also discussed. (DLC)

17777 (AEC-tr-7409, pp 152-166) PHYSICO-CHEMICAL INVESTIGATION OF THE THERMO-EMISSIVE-PROPERTIES OF METALS AND ALLOYS. Burov, I. V.; Litvak, L. N. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

A review is presented of the state of knowledge of the emissivity (work functions) of metals and alloys. Both experimental and theoretical work are covered, and the following metals are among those considered: W, Mo, Nb, Ta, Re, Mo–Ru, Ti–Hf, Re–Ru, Mo–Nb, Ni–La, Ni–Y, Mo–Rh. (5 tables, 5 fig., 23 references) (DLC)

17778 (AEC-tr-7409, pp 174-181) CALCULATION OF THE ELECTRICAL CONDUCTANCE OF SOME ALLOYS. Burov, I. V.; Pirogova, S. V. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

The following alloys are covered: Mo–Nb, W–Ta, W–Nb, Mo–W. (DLC)

17779 (AEC-tr-7409, pp 181-186) CONSTRUCTION OF THE COMPOSITION PROPERTIES DIAGRAMS OF SUPER CONDUCTING SYSTEMS BY THE SIMPLEX CRYSTAL LATTICE METHOD THROUGH THE EMPLOYMENT OF THE ELECTRONIC COMPUTING MACHINE. Efimov, Ju. V.; Kozlova, N. D. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

The simplex crystal lattice, a rule for the distribution of points on planes inside the concentration triangles, is used to study the dependence of the superconductivity on the composition of ternary and multi-component systems. The alloy system used in the study is V–Nb–Ta–Ti. (DLC)

17780 (AEC-tr-7409, pp 186-191) INVESTIGATION OF THE MECHANICAL PROPERTIES OF URANIUM METAL. Terehova, V. F.; Tylkina, M. A. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

A universal instrument used by E. M. Savitskii for micromechanical tests at high and low temperatures in air, vacuum, and protective atmospheres is described. The hardness of U was measured at –196 to +800°C; the plasticity diagram on slow cooling was also determined at –196 to +1100°C. Changes in elongation, compression, and impact strength are related to the three polymorphic modifications of U. A study by Savitskii of the internal friction of U is also reviewed. (DLC)

17781 (AEC-tr-7409, pp 191-201) ALLOYS OF NIOBIUM AND MOLYBDENUM WITH THE BORIDES AND CARBIDES OF THE METALS OF GROUP IV A. Zaharova, A. M. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Results of studies of the age hardening of Nb–(Ti, Zr, Hf)–B and Mo–(Ti, Zr, Hf)–carbon systems are given. Mechanisms of strengthening on age hardening are discussed. (7 fig.) (DLC)

17782 (AEC-tr-7409, pp 202-215) ALLOYS OF TUNGSTEN. Povarova, K. B. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

A study is made of the effects of interstitial and substitutional foreign atoms on the plasticity and strength of W. It is shown that C exerts a very strong effect on the properties, and that the carbide phase is hcp W_2C. Recrystallization and treatment to produce heat-resisting materials are considered. (DLC)

17783 (AEC-tr-7409, pp 219-225) MAGNESIUM ALLOYS WITH RARE METALS, AS MATERIALS OF SPECIAL PHYSICAL PROPERTIES. Dric, M. E.; Rohlin, L. L. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Mg alloys suitable for use as sound conductors (low attenuation coefficient of ultrasonic vibrations) are these containing La, Ce, or Nd; effects of these metals and of misch metal on ultrasonic attenuation are plotted. Characteristic properties are given for the alloys MDZ-1 (0.7–1.5% misch metal) and MDZ-2 (2–4% Nd) are tabulated and the attenuation mechanism discussed. Mg alloys for constructional use should have high oscillation damping capacity and also high strength; an optimum composition is 0.4 to 0.7% Zr, 0.1 to 0.3% Zn, 0.4 to 0.75% Cd, and 0.02 to 0.05% Y. (DLC)

17784 (AEC-tr-7409, pp 225-238) EFFECT OF RARE EARTH METALS ON THE STRUCTURE AND PROPERTIES OF ALUMINIUM AND ITS ALLOYS. Dric, M. E.; Kadaner, E. S. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Data in the literature are reviewed on the phase equilibria of binary and more complicated alloys of Al with Y, La, Ce, Pr, Nd, etc. The ternary system Al–Cu–Ce is among the systems discussed, and results of an investigation of its mechanical properties are given. (27 references) (DLC)

17785 (AEC-tr-7409, pp 238-245) HIGH ELECTRICAL CONDUCTING FIRE RESISTANT COPPER ALLOYS WITH RARE EARTH AND HIGHLY-MELTING (REFRACTORY) METALS. Korol'kov, A. M.; Barsova, V. G.; Lysova, E. V. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Results are presented of an investigation of the effects of alloying with Y, La, Ce, Pr, Nd, Er, Zr, Nb, and B on the electric conductivity and heat resistance of Cu. Hardness and prolonged strength were the properties measured. Results show the possibility of increasing the fire resisting property of Cu by 2 to 3 times without a substantial loss in the electric conductivity. (DLC)

17786 (AEC-tr-7409, pp 271-286) DEFORMABLE MAGNESIUM ALLOYS, ALLOYED WITH SCANDIUM AND YTTRIUM. Dric, M. E.; Sviderskaja, Z. A.; Nikitina, N. I. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

The effects of Y on the mechanical properties of the Mg–Sc–Mn alloy and of Sc on the mechanical properties of the Mg–Y–Mn alloy were investigated. (DLC)

17787 (AEC-tr-7409, pp 286-293) PRODUCTION OF MAGNETIC MATERIALS WITH THE PARTICIPATION OF RARE EARTH METALS. Terehova, V. F.; Torcinova, R. S. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Phase diagrams of some rare earths and Y with Co as a basis for selection of alloys for permanent magnets are discussed. Physico-chemical investigations are carried out on binary Sm–Co and ternary Sm–Co–Cu alloys. The polythermal section $SmCo_4$–$SmCu_5$ and its microstructure and magnetic properties in particular are studied. (DLC)

17788 (AEC-tr-7409, pp 294-307) HIGH TEMPERATURE ALLOYS OF NIOBIUM. Ivanova, K. N. May 1975. Translated from Fiziko-Khimiya Redkikh Metallov, Izdatel'stvo Nauka, Moskva, 1972.

In physico-chemistry of rare metals.

Binary Nb alloys containing 7 to 16% W and ternary Nb alloys containing up to 5% W and 5% Mo were selected as bases for the development of high-temperature alloys. Zr, Ti, and C were also added. Mechanical properties, microstructure, aging, phase equilibria, thermophysical properties, and use in electro-vacuum equipment are discussed. (DLC)

17789 (BMI-1934) CRITICAL EXPERIMENTS, MEASUREMENTS AND ANALYSES TO ESTABLISH A CRACK ARREST METHODOLOGY FOR NUCLEAR PRESSURE VESSEL STEELS. Second Quarterly Progress Report on Task Agreement No. 62. Hahn, G. T.; Gehlen, P. C.; Hoagland, R. G.; Kanninen, M. F.; Popelar, C.; Rosenfield, A. R. (Battelle Columbus Labs., Ohio (USA)). May 1975. Contract W-7405-eng-92. vp. Dep. NTIS $5.45.

The one-dimensional, Timoshenko beam-on-a-generalized elastic foundation treatment has been extended to contoured-DCB specimens and to the conditions attending tensile loading in an ordinary testing machine. Preliminary calculations show that the crack propagation and arrest events in contoured double cantilever beam (DCB) specimens are very similar to those calculated for regular DCB-specimens for comparable initiation conditions. In both cases the calculated K_{Ia}-values are between 64% and 80% of $K_{ID,min}$ and show a systematic variation with the initiation K_Q-level. In contrast with stiff wedge loading, which favors a continuous event, the calculations for rectangular and contoured DCB specimens in series with an idealized testing machine load train display one or more halts and restarts before the final arrest. Work is in progress to validate the conducting-grid method of measuring velocity. Eddy current-type proximity detectors have been adapted for measuring test piece and testing machine movements during the period of crack propagation and arrest. Studies of the effect of side grooves in rectangular DCB specimens confirm that grooves with depths representing up to 60% of the cross section have no significant effect on either K_{ID} or K_{Ia} Measurements. Wedge-angle has also been varied systematically thereby producing an ~10-fold and ~100-fold change in the compression load and stored energy, respectively, at the onset of propagation. These experiments reveal a small effect of wedge angle on the initial velocity and K_{ID}-measurement, but substantial differences in the amount of stored energy exchanged between the test piece and the machine prior to crack arrest. Preliminary results for the K_{ID}-crack velocity dependence of the 0-1, 4340 and A533B steels are presented. (auth)

17790 (BNL-19081) ELECTRON-PHONON SCATTERING IN POTASSIUM AT HIGH MAGNETIC FIELDS. Taub, H. (Brookhaven National Lab., Upton, N. Y. (USA)). Jul 1974. 19p. (CONF-740756-1). Dep. NTIS $4.00.

From international conference on electron lifetimes in metals; Eugene, Oregon, USA (7 Jul 1974).

The temperature dependence of both the zero-field resistivity and the transverse magnetoresistance of polycrystalline potassium wires (rho(300^0K)/rho(4.2^0K) equals 140 to 6000) were measured in fields H approximately less than or equal to 35 kG and at temperatures T approximately less than or equal to 4.2^0K. The principal findings are: (1) The presence of a large magnetic field H equals 35 kG does not alter the temperature dependence of rho from that observed at H equals 0; below 4.2^0K the T-dependent part of the resistivities, rho/sub T/(H equals 0) and rho/sub T/(H equals 35 kG), fit well to the function exp (-theta*/T) with the same theta* equals 23^0K. (2) Deviations from Matthiessen's rule are significantly reduced in a strong field so that the magnitude of rho/sub T/(H equals 0) approaches that of rho/sub T/(H equals 35 kG) as sample purity decreases. (3) The slope of the high-field linear magnetoresistance increases slightly (approximately less than 8 percent) from 1.5^0K to 4.2^0K. We attribute the exponential temperature dependence of rho/sub T/(H) to the freezing out of electron-phonon umklapp processes as has been shown for the zero-field resistivity. The reduction in deviations from Matthiessen's rule at high fields can be understood within semi-classical theory, but the latter cannot explain the failure of rho/sub T/(H) to saturate at high fields. A proposal by Young that electron-phonon umklapp scattering may contribute a T-dependent high-field linear magnetoresistance in potassium is considered. (auth)

17791 (CONF-7210131-P2, pp VII/1-VII/20) INFLUENCE OF SHAPING AND HEAT TREATMENT ON THE CREEP BEHAVIOR OF TiAl6V4. Breme, J. (Universitat Erlangen-Nuernberg, Erlangen, Ger.). 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II; Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet).

The phase equilibria, the alloy concentrations in the individual phases, and the transformation processes affect strongly the mechanical properties, including the creep strength, of the TiAl6V4 alloy. This was further examined on cold-worked and hot-rolled Ti alloy specimens, determing the effect of grain size and the hardness changes after precipitation at 500°C. Creep tests were carried out at 90, 300 and 500°C on both cold-worked and precipitated specimens. It was found that the mechanical properties depend strongly on the grain size which is affected by cold work and heat treatment. Long-range, 90-hour soaking at 880°C created a polygonal $\alpha + \beta$ structure which exhibited good creep strength at higher test temperatures. Separation of the α_2 and ω superlattice phases by heat treatment at 500 to 700°C also improved the mechanical properties of the alloy. Cold working together with precipitation at 500 to 700°C resulted similarly in an improvement of the creep strength up to 350°C. (TTT)

17792 (CONF-7210131-P3) PREPARATION AND PROPERTIES OF TITANIUM ALLOYS FOR AIRCRAFT APPLICATIONS. Proceedings of the 3rd Internal Colloquium of the Material Science Institute II, Erlangen, West Germany October 11-12, 1972. Part 3. Fatigue Limit. Age-hardening. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet). 1972. 77p. (In German).

Three papers are included in this volume: effect of $\alpha + \beta$ and β structure on fatigue and self-heating of TiAl6V4 and TiMo115 Zr6Sn4.5; effects of micro- and macrostructure on fatigue strength of TiAl6V4 and TiAl6V6Sn2; and tempering and mechanical properties of Al-containing TiNi (Nitinol) alloys. Separate abstracts were prepared for the first two papers. (DLC)

For abstracts of individual papers see: 17793 and 17794.

17793 (CONF-7210131-P3, pp VIII/1-VIII/39) EFFECT OF THE STRUCTURAL STATE OF $(\alpha + \beta)$- AND β-ALLOYS ON THE FATIGUE LIMITS AND SELF-HEATING. Zwicker, U.; Schaller, G. (Universitat Erlangen-Nuernberg, Erlangen, Ger.). 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II; Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet).

Following up previous findings that in case of high stresses, the structure may affect strongly the spontaneous heating of the TiAl6V4 alloy and may even cause its fracture, the influence of the rolling temperature was examined by carrying out operations at 760, 850, 950, and 1025°C, annealing the specimens for 5 minutes, and cooling them in either air or water. Hardness measurements and other tests indicated that the structure indeed exerts a strong influence on the creep strength of the TiAl6V4 and TiMo115Zr6Sn4.5 alloys. When the strength exceeded ±50kp/mm^2, the structure was found to be an important factor in the spontaneous heating, leading to fracture. The temperature may rise to a value exceeding 1000°C. (TTT)

17794 (CONF-7210131-P3, pp IX/1-IX/16) EFFECT OF MICRO- AND MACROSTRUCTURAL FORMATION ON THE FATIGUE STRENGTH BEHAVIOR OF TiAl6V4 AND TiAl6V6Sn2. Ruedinger, K.; Ismer, A. 1972. (In German).

From 3rd internal colloquium of the Material Science Institute II; Erlangen, F. R. Germany (11 Oct 1972).

In preparation and properties of titanium alloys for aircraft applications. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Technische Fakultaet).

Only recently has the structure been taken into account in the examination of the resistance against extended vibrations of Ti alloys. The macrostructure of the tested Ti alloys was examined, comparing the results with data reported in the literature on the properties of the $(\alpha + \beta)$ phases at temperatures over 1000°C. Tests were carried out with a revolving fatigue-testing machine, determining also the tensile, compressive, and fluctuating strength of the specimens after heat treatment and forging. The effect of the microstructure formed by shaping heat treatment could not be ascertained unequivocally, although a fine globular structure with a sufficient amount of transformed $(\alpha + \beta)$ phase exhibited a higher fatigue strength than the corresponding lamellar structure. β transformation and β annealing yielded intermediate fatigue strength values. Uneven and rough macrostructure appeared to reduce the fatigue strength; uniform structure seemed to increase the resistence of the alloys against vibrations. A directional effect was also noted. (TTT)

17795 (CONF-740125-(Absts)) FIFTH INTERNATIONAL SYMPOSIUM ON MAGNETIC RESONANCE, BOMBAY, INDIA, JANUARY 14-18, 1974. Abstracts. (Tata Inst. of Fundamental Research, Bombay (India)). 1974. 231p.

Abstracts of papers presented at the symposium are given. Approximately 210 abstracts are included. (JRD)

17796 (COO-1629-53) THERMAL AND ELECTRICAL MEASUREMENTS ON SOLIDS AT LOW TEMPERATURES. Progress Report. Weinstock, H. (Illinois Univ., Chicago (USA). Dept. of Physics). May 1975. Contract AT(11-1)-1629. 28p. Dep. NTIS $4.50.

Research activities are reported on thermal conductivity of MgO, phonon thermal conductivity of superconducting Pb–Tl alloys low temperature neutron irradiation of Nb_3Sn wires, thermal conductivity of Ta wires at 1.6 to 6^0K, and thermal conductivity of V at 0.8 to 15^0K. (auth)

17797 (IC-74-31) TWO PROBLEMS IN THE ELECTRONIC THEORY OF DISORDERED CHAINS. Kostadinov, I. Z. (International Centre for Theoretical Physics, Trieste (Italy)). May 1974. 13p. INIS.

The equivalence of the Anderson model and the Kronig-Penney disordered model with potential of the type $U(x) = \Sigma U_n \delta(x-na)$ is proved. For an arbitrary distribution of random intensities U_n it is shown that all electronic states are localized (Mott-Borland localization theorem). Simple expressions are presented for the exact solutions in the case of a Cauchy distribution. The density of states is calculated for different degrees of disorder in the whole energy range. It is pointed out that square root singularities remain only on the upper band edges ($ka = n\pi$), when the density of states is finite at the bottom of the bands. The Pokrovsky theorem for the probability of finding neighbor energy levels with a given difference is rederived. (auth)

17798 (LBL-2785) THERMODYNAMIC STUDIES OF Ga–In, Ga–Sb, AND Ga–In–Sb LIQUID ALLOYS BY SOLID STATE ELECTROCHEMISTRY WITH OXIDE ELECTROLYTES. Pong, R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1975. Contract W-7405-eng-48. 120p. Dep. NTIS $9.00.

Thesis.

Calcia stabilized zirconia and yttria doped thoria are used as oxide electrolytes at elevated temperatures to measure the activities of gallium in Ga–In, Ga–Sb, and Ga–In–Sb liquid alloys. The measured Ga activities of Ga–In melts are used to calculate enthalpies of mixing, which reach a maximum of 226 calories per mole at x/sub Ga/ equals 0.53. The measured Ga activities in Ga–Sb alloy melts are shown to fit a chemical reaction model postulating complexes in the melt to explain stabilization time constants on the order of one day and to result in large negative enthalpies of mixing. The limited investigation of Ga activities in Ga–In–Sb showed that Ga activities deviate strongly from ideality, as expected. The quasi-chemical model is examined, and the higher order derivations of Guggenheim are modified to account more fully for the second nearest and third nearest neighbor interactions in a cubic lattice. These higher order extensions more closely approximate the alpha parameter or zeroth order quasi-chemical model in predictions of the activity coefficients than the well known first order quasi-chemical model. (auth)

17799 (ORNL-5033) CARBON EFFECTS ON THE MECHANICAL PROPERTIES OF 2 ¼ Cr-1 Mo STEEL WELDMENTS. Klueh, R. L.; Canonico, D. A. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 40p. AT.

Weldments of 2 ¼ Cr–1 Mo steel were made by joining ½-in.-thick plates by the gas tungsten-arc process. Microstructure, macrostructure, room-temperature hardness, tensile, and creep-rupture properties were determined on weld metal, transverse weldments, and normalized-and-tempered base metal for three laboratory heats of 2 ¼ Cr–1 Mo steel with 0.003, 0.035, and 0.11% C. Welds were made with and without preheat, and the effect of postweld heat treatment was investigated. The multipass welding technique produced variations in structure and hardness across the weldments. These differences were reduced by postweld heat treatment. The microstructures, which consisted of bainite and proeutectoid ferrite, were determined by the carbon content: the higher the carbon content, the greater the amount of bainite present in the structure. Tensile tests on weld metal at 25 and 565°C showed that the strength of the steels was determined by the carbon content, with the steel having the highest carbon content being the strongest. For the transverse weldments and base metal, the 0.110% C steel was always strongest, and at 25°C the strength of the 0.035% C steel was greater than that of the 0.003% C steel. At 565°C, however, there was little difference between the 0.035 and 0.003% C steels. All transverse weldment specimens failed in the base metal. For a given temperature and carbon content, the creep-rupture properties of the weld metal were always greater than those of the transverse weldments and base metals, which had similar strengths for a given carbon content. The creep-rupture properties of weld metal, transverse weldments, and base metal showed an effect of carbon that depended on temperature. At 565°C, the 0.110% C steel had the highest strength, while the strength of the other two steels were similar. At 454 and 510°C, the strength of the 0.035% C steel approached that of the 0.110% C steel at long rupture times, and both were considerably stronger than the low-carbon steel. All but one of the transverse weldment specimens failed in base metal unaffected by the welding treatment. This test, a 0.110% C steel specimen with the longest rupture life at 565°C, failed in the heat-affected zone. (auth)

17800 (ORNL-5105) MECHANICAL PROPERTIES TEST DATA FOR STRUCTURAL MATERIALS. Quarterly Progress Report for Period Ending April 30, 1975. Hill, M. R. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 411p. AT.

This report presents the results of all structural materials mechanical properties test programs sponsored by the Reactor Research and Development division of ERDA: tensile properties of 304 and 316 stainless steels (ss) after fatigue and creep-fatigue cycling; tensile properties of Inconel 718 and its INEL heat treatment; surface effects on low-cycle fatigue of 304 ss; microstructural effects on low-cycle fatigue of high-purity Fe–20Cr–Ni austenitic alloys; effects of flowing Na (600–700°C) on creep-rupture properties of 304 ss; effects of 600° C Na on fatigue of 316 ss; creep tests and their effect on tensile properties of 304 and 316 ss; heat-to-heat variations of mechanical properties of 304 and 316 ss; relations between mechanical properties of ss; aging effect on mechanical properties of 304 and 316 ss; failure criteria development for 304 and 316 ss; data base for Mechanical Properties Data Storage and Retrieval System; static Young's modulus of 2¼ Cr–1 Mo steel; creep-rupture of Type 16-8-2 ss weld metal; effect of aging on creep-rupture of Type 308 CRE SMA weldments; 1200°F creep-rupture of manual GTA weldments of Types 308, 316, and 16-8-2 ss; effects of strain rate on tensile properties of annealed 2¼ Cr–1 Mo steel; tensile, fatigue, creep-fatigue, and subcritical crack growth of 2¼ Cr–1 Mo steel; mechanical property correlations for annealed 2¼ Cr–1 Mo steel; mechanical properties of weld-overlaid ss forging; creep-rupture and tensile characterization of reference heat of 304 ss; relaxation and cyclic creep of 2¼ Cr–1 Mo steel; uniaxial creep-rupture tests of 304 ss; tensile properties of Hastelloy X; creep testing of 304 ss; subgrain misorientation and second-phase particles in fatigued Incoloy 800; creep of 2¼ Cr–1 Mo steel; and decarburization rates of 2¼ Cr–1 Mo steel. (DLC)

17801 (ORNL-TM-4969) STEAM GENERATOR MATERIALS TECHNOLOGY PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1975. Patriarca, P. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 211p. AT.

Research is reported in programs on steam generator materials, welding materials, nondestructive testing, alloy 800 development, and fabrication and weld process development. (JRD)

17802 (TID/SNA-2047) LOW-CYCLE FATIGUE OF TYPE 347 STAINLESS STEEL AND HASTELLOY X IN HYDROGEN GAS ENVIRONMENT. Final Report. Jaske, C. E.; Porfilio, T. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 20 Dec 1971. 60p. Dep. NTIS $6.00.

For Aerojet Nuclear Systems Co., Sacramento, CA.

An experimental investigation has been conducted to assess the low-cycle fatigue resistance of two alloys, Type 347 stainless steel and Hastelloy X, that are being considered for use in nuclear-powered rocket vehicles. Constant-amplitude, strain-controlled low-cycle fatigue tests were conducted under compressive strain cycling at a constant strain rate of 10^{-3} s^{-1}. Specimens were tested in a purified hydrogen gas environment at temperatures of 1000, 1400, and 1600°F. Specimens were obtained from three heats of Type 347 stainless steel bar and two heats of Hastelloy X bar. At each temperature, low-cycle fatigue tests were conducted at total strain ranges of 1.5, 3.0, and 5.0 percent. Three replicates of each test condition were used for each heat of Type 347 stainless steel and four replicates were used for each heat of Hastelloy X. Information on cyclic hardening and/or softening behavior was developed for both alloys at all three temperatures. Total, elastic, and plastic strain range versus fatigue life curves were developed for each of the five heats of material at each of the three temperatures. (auth)

17803 (TID/SNA–2053) MATERIALS PROPERTIES DATA BOOK. Addendum. (Aerojet-General Corp., Sacramento, Calif. (USA)). 15 Nov 1970. 43p. Dep. NTIS $5.25.

Property data are given on Inconel 718, AISI 347, Al-base alloys, Ti-base alloys, alloy A 286, AISI 440 C, thermal insulation, brass, stainless steels, Cu-base alloys, Invar, and Si steel. (JRD)

17804 (TID/SNG-17) CREEP OF 347 STAINLESS STEEL IN HYDROGEN. Final Report. (General Electric Co., Cincin-

nati, Ohio (USA). Nuclear Systems Programs). 15 Mar 1972. 74p. Dep. NTIS $6.75.

For Aerojet Nuclear Systems Co., Sacramento, CA.

Results of creep tests on specimens of 347 stainless steel in hydrogen at 1200, 1400, and 1600°F are presented in plots and tables. (JRD)

17805 (TID/SNM-59) COMPRESSION LOW-CYCLE FATIGUE OF TYPE 347 STAINLESS STEEL AND HASTELLOY X AT ELEVATED TEMPERATURES. Porfilio, T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 17 Apr 1972. 14p. Dep. NTIS $4.00.

For Aerojet Nuclear Systems Co., Sacramento, CA.

Results of low-cycle fatigue tests on 347 stainless steel and Hastelloy X at 1100, 1200, and 1300°F are presented. Metallographic examinations revealed that both the hold and no-hold specimens contained grain-boundary voids adjacent to the fracture. The no-hold specimens had much larger voids, which appear to have formed at inclusions. In the no-hold specimens, strain was better defined and directionally oriented. In the hold specimens, strain had no directional orientation. (auth)

17806 (TR-696-26-015) MAGNETIC MATERIALS TEST REPORT. Donelan, L. (Atomics International Div., Canoga Park, Calif. (USA)). 18 Jul 1969. 27p. Dep. NTIS $4.50.

Two magnetic materials, Hiperco 27 and Armco Magnetic Ingot Iron, were tested for their magnetic stability with time at 800 to 1200°F. Both materials are magnetically stable with time. Hiperco 27 has better magnetic performance than Armco Magnetic Ingot Iron, both at high temperature and high flux densities. Impact tests made indicate Hiperco 27 is more brittle at room temperature, but less brittle at elevated temperature than Armco Magnetic Ingot Iron. (auth)

17807 (WAPD-TM-1192) BASE MATERIALS PROPERTY STUDY OF NiCrFe ALLOY 718 (LWBR DEVELOPMENT PROGRAM). Kaufman, S. F. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Jul 1975. Contract AT(36-1)-GEN-14. 64p. Dep. NTIS $6.25.

NiCrFe Alloy 718, in sheet, bar, and wire form was evaluated in the as-received, as-received and aged, single-braze and aged, and double-braze and aged conditions. Specific tasks included tensile testing (RT and 600°F), hardness (R15N and microhardness), metallographic examination (photography, grain size, and microcleanliness), dimensional stability, and examination for exaggerated grain growth during brazing. In addition, an evaluation of strain-rate and specimen-size effects on tensile properties was performed on material supplied in the various heat-treated conditions. (auth)

17808 HUGONIOT EQUATION OF STATE OF THE LANTHANIDES. Carter, W. J.; Fritz, J. N.; Marsh, S. P.; McQueen, R. G. (Los Alamos Scientific Lab., NM). J. Phys. Chem. Solids; 36: No. 7/8, 741-752(Jul 1975).

Shock wave studies of the lanthanide series show the existence of a very high pressure phase transition in all members of the series. The data show that this transformation is of necessity to a more incompressible phase and has been identified with melting. Thermodynamic considerations allow calculation of the solid–liquid phase boundary from these data; the results indicate that all the rare earths melt anomalously at sufficiently high pressures. This can be understood in the context of a "two fluid" theory, in which the composition of the liquid along the phase boundary changes continuously with pressure due to the degree of pressure-induced electronic transition present in the liquid. Hence, at sufficiently high pressure, the density of the liquid becomes greater than the density of the contiguous solid and dP/dT becomes negative. (auth)

17809 EFFECT OF CORRELATION ON THE BAND STRUCTURE OF CERIUM. Rao, R. S. (Indian Inst. of Tech., Bombay); Majumdar, C. K.; Shastry, B. S.; Singh, R. P. Pramana.; 4: No. 1, 45-52(Jan 1975).

The electronic band structure of f.c.c. phase of the rare earth metal cerium (α-cerium) has been calculated using a formulation of the crystal potential where correlation also has been included in addition to exchange. We use the prescription of Cohn and Sham as well as that of Overhauser. The Green's function method of Korringa–Kohn and Rostoker has been used for obvious advantages in the calculation. The calculations indicate that the s–d bands are hybridized with the f-levels but the f-bands are fairly narrow and lie slightly above the Fermi level. The structure of the bands is qualitatively similar to those of calculations by others except for a general shift of the entire set of bands by about 0.1 Ryd. The density of states has been calculated from the bands obtained. The spin susceptibility of α-cerium has also been calculated using the Kohn–Sham method. However, the calculated additional contributions to the band structure values still cannot explain the large experimental values reported in the literature. (5 figures) (auth)

17810 PLUTONIUM–DOKUMENTATION. Transplutonium Elemente. Referate Zeitschrift. Marz 1975. Band 9, Heft 3. 208 Referate (Register–Nr. 809-1203); 84 Referate (Register–Nr. 175T–258T)). (Plutonium Documentation. Transplutonium Elements. Abstract Journal. March 1975. Volume 9, No. 3. 208 Abstracts (Register No. 809–1203); 84 Abstracts (Register No. 175T–258T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung m.b.H. (Mar 1975). 245p. (In German and English).

This journal is intended to provide continued information on new plutonium literature to every scientist and engineer concerned with plutonium and related problems in the fields of chemistry or metallurgy, nuclear physics, reactor physics or nuclear engineering, biology or medicine. Any literature of unrestricted distribution dealing with the element plutonium are recorded in this abstract journal, including literature from Eastern countries. Important abstract journals, such as "Nuclear Science Abstracts" and "Chemical Abstracts", are also scanned. The literature is arranged by a very detailed subject classification preceding each issue in German and English. Major subdivisions are physical properties of Pu, its alloys, and its compounds; chemistry of Pu and its compounds—reprocessing and isotope separation; alloys and metal–metalloid systems with Pu; Pu production by nuclear reactions; handling of Pu; utilization of Pu; economic problems, development programs; and history and bibliographies. (RWR)

17811 RECOMBINATION OF CRYSTALLOGRAPHIC ORIENTATION OF THE SURFACE LAYERS OF TUNGSTEN AND MOLYBDENUM SINGLE CRYSTALS AFTER MECHANICAL AND THERMAL TREATMENT. Larikov, L. N.; Maksimenko, E. O. (Inst. of Metal Physics, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 4, 376-378(Apr 1975). (In Ukrainian).

Structural changes in the surface layers of tungsten and molybdenum single crystals after mechanical and thermal treatments were studied. Restoration of single crystal surfaces distorted by mechanical treatment results from secondary recrystallization during high-temperature annealing, when the non-distorted matrix single crystal absorbs the fine-grained surface layer. This makes it possible to use single crystals after the mechanical treatment with abrasive and diamond disks, cutters, and cutting tools without additional polishing of the samples. (auth)

17812 ^{57}Fe MOESSBAUER STUDIES OF THE (RE)Fe_3 INTERMETALLIC COMPOUNDS. Arif, S. K.; Bunbury, D. St. P.; Bowden, G. J.; Day, R. K. (Univ. of Manchester, Eng.). J. Phys., F (London).; 5: No. 5, 1048-1063(May 1975).

The methods described in a previous paper are used to analyze the complicated ^{57}Fe Moessbauer spectra of the (RE)Fe_3 intermetallic compounds, where RE = Gd, Tb, Dy, Ho, Er, and Y. The resultant hyperfine parameters are then used, in conjunction with local dipolar field calculations, to infer directions of preferred magnetization. In particular, it is shown that at 77°K, $HoFe_3$ magnetizes along an a axis, $TbFe_3$ along a b axis and $ErFe_3$ either along or close to a c axis. The case of $DyFe_3$ however is slightly more complex and it appears that this compound does not magnetize along a principal hexagonal axis. Some similarities between the Moessbauer spectra of the (RE)Fe_2 and (RE)Fe_3 compounds are also noted. (auth)

17813 4f BAND ENERGIES IN THULIUM. Islam, M. M.; Newman, D. J. (Queen Mary Coll., London). J. Phys., F (London).; 5: No. 5, 939-947(May 1975).

An APW calculation has been made giving the 4f band energies in hcp Tm metal for four high symmetry values of k. Crystal field parameters are determined and compared with experimental results for dilute systems. It is then argued that this type of parametrization is inadequate for pure rare earth metals and should be replaced by a model in which the hybridization matrix elements between the 4f and conduction band are parameters. (auth)

17814 HYPERFINE MAGNETIC FIELDS OBSERVED AT SCANDIUM NUCLEI IN IRON, NICKEL, AND THE INTERMETALLIC COMPOUND $GdFe_2$. Colley, M. G.; Chaplin, D. H.; Swan, D. E.; Wilson, G. V. H. (Royal Military Coll., Canberra, Australia). J. Phys., F (London).; 5: No. 5, L80-L82(May 1975).

Unique hyperfine fields of −13.2T, −2.50T and +9.1T have been observed at ^{46}Sc nuclei in iron, nickel and $GdFe_2$, respectively. (auth)

17815 PRESSURE DEPENDENCE OF T_c FOR THE TRANSITION METALS: BCC SOLID SOLUTION ALLOYS IN THE SYSTEM Zr–Nb–Mo–Re. Smith, T. F.; Shelton, R. N. (Univ. of California, La Jolla, San Diego). J. Phys., F (London).; 5: No. 5, 911-922(May 1975).

The variation of the superconducting transition temperature T_c for bcc solid solution alloys in the system Zr–Nb–Mo–Re has been investigated as a function of hydrostatic pressure up to

25 kbar. Values of $\partial T_c/\partial P$ calculated from the theoretical model of Garland and Bennemann are compared with those measured, which are both positive and negative in sign. Satisfactory agreement with the overall trend of $\partial T_c/\partial P$ with composition can be obtained for a reasonable choice of the physical parameters required, though differences in detail are apparent. (auth)

17816 RENORMALIZATION OF MAGNETIC EXCITATIONS IN PRASEODYMIUM. Lindgaard, P. A. (Danish Atomic Energy Commission, Risoe). J. Phys., C (London); 8: No. 9, L178-L181 (7 May 1975).

The magnetic exciton renormalization and soft-mode behavior as the temperature approaches zero of the single-doublet magnet (DHCP)Pr are accounted for by a self-consistent RPA theory with no adjustable parameters. The crystal-field splitting between the ground state and the doublet is D = 3.74 MeV and the ratio between the exchange interaction and D is very close to unity. However, zero-point motion prevents the system from ordering. (auth)

17817 DETERMINATION OF DIFFUSION COEFFICIENT FOR RADIOACTIVE XENON IN MOLYBDENUM. Bekmukhambetov, E. S.; Daukeev, D. K.; Zhotabaez, Zh. R.; Ibragimov, Sh. Sh.; Reutova, N. A. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 76-78(1974). (In Russian).

The diffusion coefficient, D, was determined for xenon, produced in decay of the fission product ^{133}I, in molybdenum by irradiation of molybdenum samples in contact with a layer of fissioning material. The coefficient found by comparing the experimentally determined distribution of xenon after a 50-hr diffusion annealing with calculated data showed that at T = 1340°C, $D = 1 \times 10^{-13}$ cm^2/sec and at 1507°C, $D = 3 \times 10^{-13}$ cm^2/sec. (2 figures) (tr-auth)

17818 HIGH-TEMPERATURE ENTHALPY OF LIQUID LANTHANUM BY LEVITATION CALORIMETRY. Stretz, L. A.; Bautista, R. G. (Ames Lab., IA). J. Chem. Thermodyn.; 7: No. 1, 83-88(Jan 1975).

A levitation calorimetry technique was used to measure the enthalpy of liquid lanthanum from 1250 to 2420°K. Lanthanum samples ranging from 0.5 to 2 g were levitated and melted in an inert atmosphere using a 15 kVA, 450 kHz radio-frequency generator. The results, in the temperature range 1250 to 2420°K, were fitted by the following equation where the indicated errors were obtained from the average deviation of the results from the values predicted by the equation: $\{H(T) - H(298.15\ K)\}/J\ mol^{-1} = (32.77 \pm 0.18)(T/K) - (2289 \pm 343)$. Convection and radiation heat losses during the fall of the sample from the levitation chamber into the calorimeter amounted to 0.5 to 2.0 and 2 to 5% of the total enthalpy respectively. The levitation calorimetry method is estimated to have a maximum error of ± 2.5%. (auth)

17819 THERMODYNAMIC PROPERTIES AND PHASE DIAGRAM OF TERNARY SODIUM ALLOYS. III. The System Sodium + Mercury + Indium. Neethling, A. J. (Atomic Energy Board, Pelindaba, Pretoria). J. Chem. Thermodyn.; 7: No. 1, 73-75(Jan 1975).

Electromotive force measurements in the temperature range 670 to 760°K have been used to determine the thermodynamic properties of the sodium in ternary mixtures of sodium + mercury + indium. The corresponding functions for the mercury and indium were calculated by Darken's method. Thermal analysis was used to determine the solid-liquid equilibrium surface. (auth)

17820 INFLUENCE OF GRAIN SIZE ON THE INTERATOMIC DISTANCE IN HEAVY RARE EARTHS. Vergand, F. (Univ., Paris). Philos. Mag.; 31: No. 3, 537-550(Mar 1975). (In French).

The crystal structure of four heavy rare earths, Gd, Tb, Dy, Er, and of the two divalent ones, Eu and Yb, was studied by electron diffraction. A decrease in the interatomic distance d_1 was observed for very fine particles (< 100 Å); d_1 shows a linear behavior with respect to inverse grain size ϕ for trivalent rare earths. It can be interpreted by a surface tension term in the total energy of the system. Moreover, europium and ytterbium exhibit a discontinuity in d_1 near ϕ = 30 Å, which denotes a sudden valence change. (auth)

17821 THEORY OF INELASTIC NEUTRON SCATTERING FROM Cr AND ITS ALLOYS NEAR THE NEEL TEMPERATURE. Sato, H.; Maki, K. (Tohoku Univ., Sendai). Int. J. Magn.; 6: No. 3-4, 183-209(1974).

The inelastic neutron scattering of Cr and its alloys near the Néel temperature is studied theoretically. Use is made of a two-band model to describe the antiferromagnetic correlation, where the Fermi surfaces of both the electron and the hole band are assumed octahedral but of different size in general. Above the Néel temperature, the spin susceptibility is very similar to the one obtained previously by Liu (Phys. Rev.; B2: 2664 (1970)), except that, in the incommensurate spin density wave (ISDW) region, the susceptibility becomes anisotropic with respect to the momentum direction relative to the crystal axis. Below the Néel temperature, on the other hand, the susceptibility decomposes into two terms; the longitudinal and the transverse components. The transverse component has poles associated with the spin wave mode both in the CSDW and the ISDW region. Contrary to Liu, it is found that the imaginary part of the transverse susceptibility develops well-defined peaks associated with the spin wave mode, which persists in all temperatures below T_N. (auth)

17822 RE-EXAMINATION OF THE HEAT OF FUSION OF INDIUM. Richardson, M. J.; Savill, N. G. (National Physical Lab., Teddington, Eng.). Thermochim. Acta.; 12: No. 3, 221-226 (Jul 1973).

The currently accepted value of the heat of fusion, ΔH, of indium is shown to be of doubtful accuracy so that indium is an unsuitable calibrant in differential scanning calorimetry. ΔH was redetermined using a DSC calibrated with alumina, a technique which is shown to reproduce enthalpy changes in a variety of materials with an accuracy of ± 1%. The heat of fusion of indium is 3.35 kJ g-at^{-1} (29.2J g^{-1}). (auth)

17823 THERMODYNAMIC AND CRYSTALLOGRAPHIC PROPERTIES OF REPd INTERMETALLIC COMPOUNDS. Palenzona, A.; Cirafici, S. (Univ., Genoa). Thermochim. Acta.; 12: No. 3, 267-275(Jul 1975).

REPd phases were extensively studied both by thermal, crystallographic, thermodynamic and micrographic methods. A possible sequence of structures is proposed which is correlated with the thermal and thermodynamic data. Europium is a divalent rare earth in EuPd while ytterbium in YbPd seems to be present with a certain fixed percentage of atoms in the trivalent state. (auth)

17824 HEAT CAPACITY OF THE SUPERCONDUCTING KONDO SYSTEM (LaCe)Al_2. Bader, S. D.; Phillips, N. E.; Maple, M. B.; Luengo, C. A. (Univ. of California, Berkeley). Solid State Commun.; 16: No. 10/11, 1263-1266(1 Jun 1975).

Heat capacity measurements between 0.07 and 20°K and 0 and 38 kOe are reported for the system (LaCe)Al_2. Normal state measurements show that the crystal-field ground state of the Ce ion is a doublet and reveal a characteristic Kondo anomaly in zero magnetic field. In the superconducting state there is evidence for an impurity band at low energies within the gap, and for a second order transition at the lower critical temperature T_{c2}. (auth)

17825 SUPERPLASTICITY. Gittus, J. (United Kingdom Atomic Energy Authority, Salwick, Eng.). pp 509-557 of Creep, Viscoelasticity, and Creep Fracture in Solids. Gittus, J. (ed.). London; Applied Science Publishers (1975).

This review is concerned with maximizing the rupture ductility. It opens with a general discussion under the headings: stable tensile deformation; origins of superplastic behavior (environmental superplasticity, superplasticity and dynamic recovery and vacancy migration, grain-boundary sliding - diffusion-accommodated flow). The subject is continued in sections dealing with a number of different materials: tungsten alloys, plutonium, uranium, and zirconium and its alloys. (UK)

17826 ANISOTROPIC TEMPERATURE-DEPENDENT RESISTIVITY OF Cd, Zn, AND Mg. Alderson, J.E.A.; Hurd, C.M. (National Research Council of Canada, Ottawa, K1A 0R9, Canada). Phys. Rev. B 12: No. 2, 501-508 (15 July 1975).

The electrical resistivity observed along and perpendicular to the hexagonal axis has been measured in monocrystals of Cd, Zn, and Mg over the range $\simeq$ (3-300) °K [$\simeq$ (3-590) °K for Cd]. The temperature dependence of the anisotropy parameter ($\alpha = \rho_\parallel/\rho_\perp$) has been examined in the light of the Case-Gueths simplified model of conductivity in an anisotropic metal. In the case of Cd there is good quantitative agreement with the predictions of the model, while in Zn there is at least good qualitative agreement with them. But for Mg (which alone has $\alpha < 1$) quite the wrong behavior of α (T) is observed. It is suggested that the discrepancy reflects the oversimplified view of the Fermi surface which is used, particularly since it neglects the conductivity in the basal plane arising from the third-band "needles"—which of course are absent in Cd and genuinely negligibly small in Zn. (auth)

17827 SPIN-ORBIT EFFECTS IN THE ELECTRONIC STRUCTURE OF THE (001) SURFACE OF BCC 4*d* AND 5*d* TRANSITION METALS. Feder, R.; Sturm, K. (Institut für Festkörperforschung der Kernforschungsanlage Jülich, 517 Jülich, Germany). Phys. Rev. B 12: No. 2, 537-548 (15 July 1975).

In view of explaining surface-sensitive structures observed in recent field-emission and photoemission experiments, a formalism is developed for the investigation of the electronic structure in the vicinity of the Fermi energy of the (001) surface of bcc 4*d* and 5*d* transition metals. Starting from a three-band model tight-binding fit to a known bulk band structure along ΓH that contains spin-orbit effects, the Green's

function for an infinite crystal is obtained, and subsequently employed in a Dyson equation for the Green's function of a finite crystal. From the latter function, the local densities of states per monatomic layer for $k_{\parallel} = 0$ are determined. The numerical application of this formalism to W(001) and Mo(001) reveals a very pronounced surface resonance in a "relative" band gap just below the Fermi energy and a surface state in an "absolute" gap somewhat further below. The resonance provides an explanation for a surface-sensitive peak below the Fermi level that has been found in a large number of field and photoemission energy distribution measurements. For the surface state, however, there is no clear experimental evidence. For Nb(001) and, in particular, Ta(001), analogous features are predicted above the Fermi level. (auth)

17828 ON THE APPLICABILITY OF THE CRITERIA OF THE INSTABILITY OF GROUPS TO THE STUDY OF POSSIBLE SUPERCONDUCTORS. Kodess, B. N. (Kirov Polytechnic Inst., USSR). Solid State Commun.; 16: No. 10/11, 1259-1262(1 Jun 1975). (In French).

In all superconductors with high values of T_c, an instability exists in the crystal lattice. This instability is the principal indicator of strong interactions between the quasiparticles in the macrosystem. Presence of the transitional structure of martensitic steel, of a cooperative character, is considered as one possibility favoring the existence of other transitional non-structural phases of a cooperative type including superconductor transition phases. The special properties of low temperature transitions in A 15 compounds were also considered. (auth)

17029 ROLE OF TWIN BOUNDARY/GRAIN BOUNDARY INTERSECTIONS ON MICROCRACKING BEHAVIOR OF AISI 304 STAINLESS STEEL DEFORMED IN SLOW TENSION AND CREEP AT 650°C. Nahm, H.; Moteff, J. (Cincinnati Univ., OH). J. Mater. Sci.; 10: No. 6, 1084-1087(Jun 1975).

Quantitative observations are presented of the influence of twin boundary/grain boundary intersections (TGI) on the intergranular cracking behavior in AISI 304 stainless steel deformed in the slow tension and creep rupture modes at 650°C. It is apparent that both the intergranular cracks related to TGI's and the secondary cracks increase with decreasing deformation rate. (UK)

17830 REMARKS ON SOME EXCEPTIONS TO THE ENGEL-BREWER RULES. Hill, H. H. (Los Alamos Scientific Lab., NM). J. Phys. Chem. Solids; 36: No. 7/8, 830-831(Jul 1975).

Reference is made to the success of the Engel-Brewer theory of metals (J. Nucl. Mater. 51:2 (1974) and references therein) in making predictions regarding phase stability relationships in transition metals and alloys. Among these predictions are those relating to the crystal structural changes in transition metals that may be expected upon application of external pressure. The reasoning used in this valence bond method, involving the electronic configurations of the metals, is summarised. It is shown, however, that there are exceptions in the case of some rare earth elements, and possible reasons for this situation are discussed. (UK)

17831 LARGE STRAIN DEFORMATION OF POLYCRYSTALLINE METALS AT LOW HOMOLOGOUS TEMPERATURES. Hockett, J. E. (Los Alamos Scientific Lab., NM); Sherby, O. D. J. Mech. Phys. Solids.; 23: No. 2, 87-98(Apr 1975).

Large strain compression data (true strains to about -3.0) are presented for polycrystalline αU and αFe at room temperature. The results, together with other published data at low homologous temperatures ($\approx 0.2\ T_m$), where T_m is the absolute melting temperature, suggest that a steady-state flow stress σ_s is approached after extensive strain hardening. αU exhibits a very high strain-hardening rate, with $\sigma_s \approx 2900$ MPa (420 ksi) indicating that cold working is a very potent method of strengthening this metal. All the data evaluated can be fit by the stress-strain relation $\sigma = \sigma_s - \exp(-(N\epsilon)^p)(\sigma_s - \sigma_y)$, where σ_y is the yield stress, p is a constant equal to about 0.58 for the metals analyzed, N is a constant associated with the strain-hardening characteristics of a material, σ is true stress, and ϵ is true strain. (auth)

17832 DEFECT STRUCTURE AND SUPERCONDUCTING TRANSITION OF COLD-WORKED NIOBIUM. Thompson, S. J.; Flewitt, P. E. J. (Central Electricity Generating Board, Cockfosters, Eng.). J. Less-Common Met.; 40: No. 3, 269-283(May 1975).

The dislocation structure of polycrystalline niobium (oxygen < 50 ppM), deformed both by cold rolling and cold drawing, has been correlated with macrohardness, microhardness, and superconducting transition temperature. For both strip and wires, up to 10% deformation, the dislocations are fairly uniformly distributed and have Burgers vectors of the type $a/2\langle 111\rangle$ and a $\langle 100\rangle$ with the $a/2\langle 111\rangle$ dislocations in screw orientation. By 20% deformation a pronounced cellular arrangement of dislocations occurs. The variation of hardness with deformation for both strip and wire relates to the size of the dislocation cells and obeys a relationship of the form $H = H_0 + Kd^{-m}$ (where m = 1). Evaluation of K for the strip indicates that cell walls perpendicular to the plane of rolling have a greater resistance to plastic flow than those parallel to the plane of rolling. In the case of wires (both sections), the value for K is similar to that obtained for strip in the plane of rolling. The superconducting transition temperature (T_c) is critically dependent upon the number and arrangement of the dislocations. Up to 10% deformation, T_c increases linearly with the dislocation density, but with the onset of the cellular arrangement of dislocations T_c decreases linearly with cell size. (auth)

17833 CRYSTALLOGRAPHIC DATA FOR INTERMEDIATE PHASE IN THE COPPER-ZIRCONIUM AND COPPER-HAFNIUM SYSTEMS. Bsenko, L. (Univ., Uppsala). J. Less-Common Met.; 40: No. 3, 365-366(May 1975).

Cu-Zr and Cu-Hb alloys containing 30 to 80 at.% Cu were prepared and examined by metallographic and x-ray analysis in order to establish the compositions and cell dimensions of the various phases. (JRD)

17834 CRYSTAL STRUCTURE AND MAGNETIC PROPERITES OF $YFe_{2x}Al_{2-2x}$ COMPOUNDS. Buschow, K. H. J. (Philips Research Labs., Eindhoven, Netherlands). J. Less-Common Met.; 40: No. 3, 361-363(May 1975).

Samples prepared by arc melting 99.9% pure Y and Fe and 99.99% pure Al were vacuum annealed at 1100°C. Data on the composition dependence of the structure in the series are presented in tables and plots and discussed. (JRD)

17835 X-RAY DIFFRACTION DATA OF PALLADIUM-RICH CERIUM-PALLADIUM ALLOYS. Rossi, D.; Ferro, R.; Marazza, R. (Univ., Genoa). J. Less-Common Met.; 40: No. 3, 345-350 (May 1975).

Pd-rich alloys were prepared by arc melting under Ar atmosphere. The results are based on chemical analysis, metallographic analysis, thermal analysis, and density measurements in addition to x-ray examination. Crystallographic data are presented and discussed along with plots of lattice parameters and micrographs. (JRD)

17836 LONG-PERIOD SUPERLATTICES DUE TO ORDERING OF PAIRS OF SUBSTITUTION ATOMS IN RM_5 HAUCKE PHASES. Deportes, J.; Givord, D.; Lemaire, R.; Nagal, H. (CNRS, Grenoble-Cedex, France). J. Less-Common Met.; 40: No. 3, 299-304(May 1975). (In French).

The crystallographic structures of two new phases in Ce-Mg alloys have been studied by single-crystal x-ray methods. The structures reveal long-period superlattices due to partial ordering of the substitution of two Mg atoms for one Ce atom in the $CaCu_5$ structure. The occurrence of twins associated with the symmetry of the $CaCu_5$ subcell can lead to a hexagonal symmetry of the diffraction patterns. The disordered character of these structures is explained in terms of the solubility of substitution atoms in the $CaCu_5$ matrix. (auth)

17837 THERMALLY ACTIVATED SOLID-SOLUTION HARDENING OF THE TERNARY SYSTEM: NIOBIUM-MOLYBDENUM-TUNGSTEN. Koss, D.; Hack, J. (Michigan Technological Univ., Houghton). J. Less-Common Met.; 40: No. 3, 305-311(May 1975).

The temperature dependence of the flow stress of ultra-high-vacuum-degassed Nb-Mo-W single crystals has been investigated between 77 and 900°K. Tests of alloys containing up to 9.4 at.% (Mo + W) show that the thermal component of the flow stress exhibits little or no increase with increasing ternary-solute content for most of the alloys tested. Solid-solution softening is observed in the Nb-4.2 Mo-W alloys at 77°K. The results are interpreted utilizing a phenomenological analysis of the solid-solution hardening increments. The analysis of the results suggest that a non-random solute distribution is responsible for reducing the thermally-activated, flow-stress component, especially in concentrated alloys with a Mo to W ratio of near unity. (auth)

17838 EFFECT OF HIGH PRESSURE ON THE CRYSTAL STRUCTURES OF LANTHANIDE TRIALUMINIDES. Cannon, J. F.; Hall, H. T. (Brigham Young Univ., Provo, UT). J. Less-Common Met.; 40: No. 3, 313-328(May 1975).

The effect of high pressure on the crystal structures of $LnAl_3$ (Ln = Lanthanide) compounds has been determined by exposing $LnAl_3$ compounds or stoichiometric mixtures of the elements, to high-pressure and high-temperature conditions in a tetrahedral-anvil apparatus. In accordance with considerations of relative compressibilities, the application of high pressure tends to make the lower-atomic-weight lanthanides behave more like those of higher atomic weight. Thus, high-pressure-induced polymorphic changes were in the direction of structures with increased cubic character. Polymorphs or compounds first reported in this paper are $BaPb_3$-type $GdAl_3$, $HoAl_3$-type $TbAl_3$ and Cu_3Au-type $LuAl_3$. The first two are hexagonal with lattice parameters a = 6.231, c =

21.173 Å, and a = 6.095, c = 35.96 Å, respectively. The third compound is cubic, with lattice parameter a = 4.186 Å. (auth)

17839 CRYSTALLOGRAPHIC AND MOESSBAUER STUDY OF (Sc, Y, Ln) (Fe, Al)$_2$ INTERMETALLIC COMPOUNDS. Dwight, A. E.; Kimball, C. W.; Preston, R. S.; Taneja, S. P.; Weber, L. (Northern Illinois Univ., Dekalb). J. Less-Common Met.; 40: No. 3, 285-291(May 1975).

Crystal structures have been studied in a series of alloys in the RFe_2-RAl_2 system in which R includes Sc, Y, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, and Lu. X-ray studies were made by the Debye–Scherrer method for arc-melted and annealed alloys. Earlier work had shown that where the composition is close to RFe_2 or RAl_2, the compounds are $MgCu_2$-type (cubic) Laves phases, but that in a composition region intermediate between RFe_2 and RAl_2 the compounds are $MgZn_2$-type (hexagonal) Laves phases. The composition limits of the $MgCu_2$- and $MgZn_2$-type structures is defined and the existence of a new $MgCu_2$-type compound based on $ScFe_2$ is reported. In general, the range of stability of the hexagonal compounds is shifted to higher aluminum concentration as the identity of the rare earth changes from Sm to Lu, although anomalous behavior is exhibited by Sc. When the regions of phase stability are depicted in a plot of volume per formula weight vs. composition, the phase boundaries between cubic and hexagonal phases are curved, but have similar shapes at both the iron-rich and aluminum-rich end of the diagram. The tendency to order into the Mg_2Cu_3Si-type structure in the hexagonal phase has been studied by x-ray diffraction; various models of this ordering are treated. Both the cubic and the hexagonal phases have been studied by the Mössbauer effect with ^{57}Fe. The hexagonal phases exhibit magnetic order at low temperatures but not at room temperature. At room temperature the cubic phases of $Ho_{33}Al_xFe_{66-x}$ are magnetic for x = 10 and nonmagnetic for x = 20 or greater. (auth)

17840 DEBYE TEMPERATURE OF LIQUID METALS. Saxena, N. S.; Bhandari, R. C. (Univ. of Rajasthan, Jaipur, India). Indian J. Pure Appl. Phys.; 13: No. 4, 270-271(Apr 1975).

Debye temperatures in the case of ten liquid metals have been calculated using two-state model of liquids at their melting temperatures, and are compared with their characteristic values in the solid phase. The latter values are found to be higher than the calculated ones. (auth)

17841 USE OF THERMODYNAMICS AND PHASE EQUILIBRIA TO PREDICT THE BEHAVIOR OF THE RARE EARTH ELEMENTS IN STEEL. Wilson, W. G. (Moly Corp. of America, Pittsburgh); Kay, D. A. R.; Vahed, A. J. Met.; 26: No. 5, 14-23(May 1975).

Examination of the standard free energy of formation data for the various rare earth (RE) compounds makes it possible to make predictions about the reactions of rare earths with oxygen, sulfur, and white metals. Most results are compatible with the theoretical predictions, whereas other predictions appear to be erroneous, and finally some of the reactions that are observed can not be explained by examination of the standard free energies of formation alone. From the phase diagrams of some of the rare earths and the "white metals" which include lead, arsenic, etc. it is possible to predict that rare earths should be able to obviate the deleterious effect of some of these elements on the mechanical properties of steel. (auth)

17842 INFLUENCE OF HEAT-TREATMENT ON THE COHESIVE RESISTANCE OF LAYERS IN SOME BIMETALS. Gogichev, I. I. Soobshch. Akad. Nauk Gruz. SSR; 78: No. 1, 137-140(Apr 1975). (In Russian).

Investigations of some bimetals obtained by explosive welding have been carried out. Resistance to direct pull and shear strength along the joint weld after heat treatment and to shear in the temperature range of 100–800°C was determined. It is shown that the resistance to direct pull (σ_B) and the shear strength (τ_B) after heat treatment and the shear strength in the hot condition remain satisfactorily high. The joints were of 1Kh18N9T steel to Mo, Nb, Cu, Al, and Ni. (auth)

17843 HEAT CAPACITY OF Nb + 7.23 AT. % Ti NEAR THE PHASE TRANSITION INTO THE SUPERCONDUCTING STATE. Shchetkin, I. S.; Kharchenko, T. N.; Tarasenko, G. I. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.).; 20: No. 3, 367-370(Mar 1975). (In Russian).

The temperature dependence was measured for heat capacity of Nb + 7.23 at.% Ti solid solution within a temperature range of 2.5—18°K including the region of phase transition into the superconducting state. The behaviour of certain thermodynamic functions (entropy, free and internal energy) was studied in normal and superconducting phases. A possibility of using the theory of multizone superconductors and the model of strong bond to describe the anomalous behaviour of these values is discussed. (4 figures) (auth)

17844 SUPERCONDUCTIVE MATERIALS. Watanabe, M. (Electrotechnical Lab., Tokyo (Japan)). Reito; 49: No. 557, 245-249(Mar 1974). (In Japanese).

The method of making wire material for obtaining the necessary characteristics of superconductive magnets and its constitution are described. Nb–Ti alloys are predominant at present. Their upper thermodynamically critical field H_{c2} is larger than 120 kOe and is suitable for generating magnetic field up to 80 kOe. Nb–Zr–Ti alloys, which have been developed in Japan, have superior critical current characteristics particularly in the side of weak magnetic field, and is suitable for generating magnetic field of less than 50 kOe. The materials for strong magnetic field introduce lattice defects, and pinning points to obtain high critical current density. The form and constitution of superconductive alloy wires have changed toward superfine multiple strands. Although many intermetallic compounds having high critical temperature were found, only two kinds of the compounds viz. Nb_3Sn and V_3Ga are utilized as wire material. The conditions under which the compounds with stoichiometric composition have microcrystalline structure to obtain high critical temperature and high critical current density may be difficult for continuous manufacturing process, but seem to be possible. Perhaps gaseous phase growth methods may be effective. Research and development on materials having high critical temperature and methods for making wire having high critical current density are urgent. (JA)

17845 THEORY OF THERMODYNAMIC PROPERTIES OF LIQUID METALS. Hasegawa, M.; Watabe, M. (Tohoku Univ., Sendai (Japan). Dept. of Physics). J. Phys. Soc. Jap.; 36: No. 6, 1510-1515(Jun 1974).

Thermodynamic properties of simple liquid metals are investigated from the fundamental point of view of the electron theory of metals. A modified form of the pressure equation appropriate to liquid metals is applied to calculations of the thermal pressure coefficient and the thermal expansion coefficient of simple metals using a pseudopotential formalism for the electron-ion interaction. Comparisons of the predictions and experiments are made, and agreement is found satisfactory for the simpler metals. (auth)

17846 LIGHTWEIGHT BERYLLIUM WINS WINGS AS REAL HEAVYWEIGHT. Strock, R. E. Jr.; Fullerton–Batten, R. C. Am. Met. Mark.; 81: No. 48, 2A; 8A(Mar 1974).

Development of Be materials with improved strength and ductility levels is possible by exploitation of new consolidation techniques, such as cold and hot isostatic pressing and plasma spraying followed by sintering. Working the vacuum hot pressed billet by cross-rolling or extruding and by forging improves the mechanical properties. The valuable contributions of Be in aerospace and nuclear applications are considered. SNAP-8 and SNAP-10A applications, replacement of an Al alloy on the Minuteman spacer ring by Be, aircraft (flight testing of F-4 Phantom with a Be rudder and actual structural application of Be wrought mill product in F-14 Tomcat) and communication satellite (despin platforms, spinning arms, truss structures) applications are discussed together with instrument applications (guidance systems for Saturn V, Minuteman and the Boeing 747, proportional counters for space-oriented x-ray experiments), Be applications in lunar explorations, expanding use of Be in space applications as a mirror blank material and Be disks for the brakes of giant aircraft. Beryllium has the highest specific heat of all structural metals and it shows chemical inertness to many of the common rocket propellants and their combustion products. Its handicaps are high cost and poor impact behavior. (Metals Abstr.)

17847 SOME INHERENT LIMITATIONS OF THE ALLOY PROCESS FOR SUPERCONDUCTING Nb_3Sn. Jatar, S.; Reddi, B. V.; Narlikar, A. V. (National Physical Lab., New Delhi). Mater. Res. Bull.; 10: No. 7, 659-663(Jul 1975).

The Alloy Process for making multifilamentary superconducting Nb_3Sn is critically examined. It is shown the process itself has certain inherent limitations to realize a reasonably high overall J/sub c/. Further, the microstructure of the material produced by this process is unfavorable for high J/sub c/ and it is shown that at low currents avalanche like process may occur driving all superconducting filaments suddenly normal. Attention is drawn to other processes which seem free from the limitations discussed. (auth)

17848 LATTICE ANOMALIES IN HIGH-TEMPERATURE SUPERCONDUCTING COMPOUNDS OF THE A15. Izyumov, Yu. A.; Naish, V. E.; Syromyatnikov, V. N. (Inst. of Physics and Metals, Moscow). Fiz. Metal. Metalloved.; 39: No. 3, 455-460 (Mar 1975). (In Russian).

In the superconducting compounds ZrV_2 and HfV_2, which have a C15 structure (Laves) phase, there recently has been observed a structural transition at low temperatures, which precedes a

softening of the lattice module. These phenomena are similar to those studied earlier in the compounds V_3Si and Nb_3Sn (A15 structure). It was shown that the space symmetry O_h^7 of the C15 structure is achieved by a two-fold degeneration of the electron levels at point X in the Brillouin zone and a linear dispersion in the neighborhood of this point—in complete analogy with the A15 structure (space group O_h^3). Extending Gorkov's hypothesis concerning the passage of the Fermi surface through point X in V_3Si and Nb_3Sn to compounds ZrV_2 and HfV_2, a logarithmic softening of the c44 module for the C15 structure unlike the shifted module C_{11}-C_{12} for structure A15 can be obtained. Experimental verification of this theory in relation to C15 compounds would be obtained indirectly, that the Labbe-Fridel chain model is not necessary for understanding the anomalous properties of V_3Si and Nb_3Sn compounds with an A15 structure. (tr-auth)

17849 DEFECT SURFACE LAYER OF MONOCRYSTALLINE LARGE-AREA MOLYBDENUM PLATES. Dobrovinskaya, E. R.; Tsigel'nitskii, G. M.; Pishchik, V. V. (Scientific Research Inst. for Monocrystals, Kharkov). Fiz. Metal. Metalloved.; 39: No. 3, 649-651(Mar 1975). (In Russian).

Selective-etching and x-ray studies showed that differences between the structural development of surfaces layers and the bulk of a crystal are due to enrichment of the surface layer in impurities, in particular, oxygen and carbon, in concentrations greater than their limits of solubility in the crystal. Large-area molybdenum plates were characterized by the presence of a defect surface layer about 100 μm thick resulting from enrichment of the surface layers with impurities. (tr-auth)

17850 PLASTIC DEFORMATION AND DESTRUCTION OF CRYSTALLINE SOLIDS. Yaroshevich, V. D.; Ryvkina, D. G. (Ioffe Inst. of Physics and Tech., Leningrad). Fiz. Metal. Metalloved.; 39: No. 3, 617-627(Mar 1975). (In Russian).

Based on experimental and theoretical studies on the relation between plastic deformation and metal destruction, a hypothesis is presented which indicates that the destruction (including embrittlement) is a localization of plastic deformation related to loss of stability of the sample. Criteria are presented for recognizing approach of destruction and experimental verification is presented. Effects related to transformation of material from the viscous to the "brittle" state are clarified, and difficulties encountered in the making of highly stable materials with sufficient plasticity are formulated. (tr-auth)

17851 INTERNAL FRICTION IN TANTALUM, NIOBIUM, VANADIUM, AND RHENIUM CONDENSATES. Zolotukhin, I. V.; Abramov, V. V.; Turkin, V. F. (Voronezh Polytechnic Inst., USSR). Fiz. Metal. Metalloved.; 39: No. 3, 591-597(Mar 1975). (In Russian).

The relaxation spectra of internal friction of finely dispersed vacuum metallic condensates of tantalum, niobium, vanadium, and rhenium, 2 to 10 μm thick were studied in a frequency range of 150 to 5000 Hz and a temperature interval of 20 to 800°C. At 200 to 600°C relaxation maxima were formed due to incorporated impurities and high concentrations of lattice defects. Possible mechanisms of anomalously high energy diffusion in the condensates are discussed. (tr-auth)

17852 POSSIBILITY OF STRENGTHENING MOLYBDENUM-RHENIUM ALLOY. Kurdyumova, G. G.; Mil'man, Yu. V.; Trefilov, V. I.; Freze, N. I. (Inst. of Problems in Materials Science, Kiev). Fiz. Metal. Metalloved.; 39: No. 3, 585-590(Mar 1975). (In Russian).

Alloying of alloy MR-47 with carbon and with zirconium carbide increased the recrystallization temperature (100 to 300°C) and increased the strength and the heat resistance while maintaining a satisfactory level of low-temperature plasticity. (tr-auth)

17853 ELECTRIC TRANSFER IN MONO- AND POLYCRYSTALLINE BERYLLIUM. Grinyuk, V. N.; Tikhinskii, G. F. (Physical-Technical Inst., Kiev). Fiz. Metal. Metalloved.; 39: No. 3, 514-518(Mar 1975). (In Russian).

Electric transfer was studied in pure beryllium at temperatures of 1123 to 1175°K. In mono- and polycrystalline samples ions were transferred in the direction of the anode under the action of electron wind forces. Anistropy of the electric transfer in beryllium was more strongly expressed than in cadmium and zinc, studied earlier. (tr-auth)

17854 EFFECT OF DYNAMIC DEFORMATION ON STRUCTURE OF VANADIUM SINGLE CRYSTALS. Rabotnov, Yu. N.; Lyuttsau, V. G.; Kostyukova, E. P.; Kostina, I. V.; Mel'shanov, A. F. (Science Research Inst. of Behavior, Moscow). Fiz. Metal. Metalloved.; 39: No. 3, 559-563(Mar 1975). (In Russian).

X-ray studies were made of structural changes in vanadium monocrystals after dinamic deformation by contraction at a rate of 10^3-10^4 along the [110] axis. It was shown that deformation at these rates occurred by twinning. (tr-auth)

17855 PHASE TRANSFORMATIONS IN QUENCHED Ti-Mo ALLOYS DURING HEATING. Ivanov, A. S.; Kaganovisch, I. N.; Makhnev, E. S.; Tomsinskii, V. S. (Perm Polytechnic Inst., USSR). Fiz. Metal. Metalloved.; 39: No. 3, 564-568(Mar 1975). (In Russian).

High-temperature roentgenography was used to study the process of destruction of the metastable α''- and β-phases in Ti—Mo alloys. Destruction of the β-phase upon heating of the metastable state took place through redistribution of the Mo, formation of depleted and enriched regions, and further formation in these regions of equilibrium α- and β-phases. Destruction of the α''-phase at low temperatures took place by separation of the α-phase and enrichment of the α''-martensite and at temperatures above 400°C by separation of β-phase and depletion of the α''-martensite. (tr-auth)

17856 MECHANISM OF RECRYSTALLIZED GRAIN FORMATION IN Mo SINGLE CRYSTALS UNDER LOADING. Zasimchuk, E. E.; Marusii, O. I. (Inst. of Stability Problems, Kiev). Fiz. Metal. Metalloved.; 39: No. 3, 569-577(Mar 1975). (In Russian).

Formation of recrystallized grains of molybdenum monocrystals in a polygon matrix was studied under high-temperature creep conditions. As deformation progressed, some of the subgrain boundaries were converted to large angles. Migration of these boundaries resulted in recrystallization of macro crystals accompanied by acceleration of deformation. (tr-auth)

Radiation Effects

Refer also to abstracts 16828, 18907, and 19052.

17857 (CONF-750703-10) DEFECT-IMPURITY INTERACTIONS IN IRRADIATED GERMANIUM. Cleland, J. W.; James, F. J.; Westbrook, R. D. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. 20p. Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

Results of experiments are used to formulate a better model for the structures of lattice defects and defect-impurity complexes in irradiated n-type Ge. Single crystals were grown by the Czochralski process from P, As, or Sb-doped melts, and less than or equal to 10^{15} to greater than or equal to 10^{17} oxygen cm^{-3} was added to the furnace chamber after approximately 1/3 of the crystal had been solidified. Hall coefficient and resistivity measurements (at 77°K) were used to determine the initial donor concentration due to the dopant and clustered oxygen, and infrared absorption measurements (at 11.7 mu) were used to determine the dissociated oxygen concentration. Certain impurity and defect-impurity interactions were then investigated that occurred as a consequence of selected annealing, quenching, Li diffusion, and irradiation experiments at approximately 300°K with ^{60}Co photons, 1.5 to 2.0 MeV electrons, or thermal energy neutrons. Particular attention was given to determining the electrical role of the irradiation produced interstitial and vacancy, and to look for any evidence from electrical and optical measurements of vacancy--oxygen, lithium--oxygen, and lithium--vacancy interactions. (auth)

17858 (HEDL-SA-775) HELIUM PRODUCTION IN REACTOR MATERIALS. Lippincott, E. P.; McElroy, W. N.; Farrar, H. IV. (Hanford Engineering Development Lab., Richland, Wash. (USA); Atomics International Div., Canoga Park, Calif. (USA)). Feb 1975. 6p. (CONF-750303-67). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Comparisons of integral helium production measurements with predictions based on ENDF/B Version IV cross sections have been made. It is concluded that an ENDF/B helium production cross section file should be established in order to ensure a complete and consistent cross section evaluation to meet accuracies required for LMFBR, CTR, and LWR applications. (auth)

17859 (HEDL-TME-75-23) IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. Semi-annual Progress Report, August 1974–February 1975. Claudson, T. T. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-2170. vp. Dep. NTIS $7.60.

Data are reported on: effects of cold work on creep-fatigue of irradiated 304 and 316 stainless steel (ss); swelling of 304 and 316 ss irradiated with protons and fast neutrons; effects of hold time on fatigue crack propagation in neutron-irradiated 20 percent cold-worked 316 ss; radiation resistance of 0.03 percent Cu A533-B steel; microstructure of irradiated Inconel 718, Incoloy 800, PH13-8Mo, Mo, and Nb; dose dependence of 2.8-MeV Ni^+ ion damage (swelling) in Ni; notch ductility and strength of 316 ss submerged arc weld deposits; effects of microstructure of 316 ss on its irradiation response; in-reactor deformation of 20 percent cold-worked 316 ss; microstructure of HFIR-irradiated 316 ss; void microstructures of V bombarded by 46-MeV Ni^{6+} ions (with and

without preinjected helium) or 7.5-MeV Ta^{3+} ions; swelling of Mo, Mo–0.5 Ti, Nb, Nb–1 Zr, W, and W–25 Re after fast neutron irradiation; swelling of V ion-irradiated Mo; creep of 20 percent cold-worked 316 ss at 850, 1000, and 1100°F; effects of fast neutrons on mechanical properties of 20 percent cold-worked 316 ss; notch effects in tensile behavior of irradiated, annealed 304 ss (EBR-II duct thimbles); equations for thermal creep in pressurized tubes of 20 percent cold-worked 316 ss; irradiation creep in cold-worked 316 ss; helium production cross sections in neutron-irradiated elements; radiation effects on tensile properties of Inconel 718, Inconel 600, and A-286; subcritical fatigue crack growth in annealed 304 ss, annealed Inconel 600, and precipitation-heat-treated Inconel 718; tensile properties of weld-deposited ss (308/308L, CRE 308, 16-8-2) and wrought 304; void growth in the irradiation of thin foils; correlation of 20 percent cold-worked and solution-annealed 316 ss swelling; displacement dose calculation for void growth in charged particle simulation experiments; electron-beam welding for reencapsulation of radioactive specimens; correlation between equivalent Cr content and resistance to radiation swelling in 316 ss; and stress effects on swelling in 316 ss. (DLC)

17860 (RD/B/N-3330) SEMI-AUTOMATIC MEASUREMENT OF SWELLING FROM TRANSMISSION ELECTRON MICROGRAPHS. Rowe, J.; Fisher, S. B. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1975. 7p. Dep. NTIS (US Sales Only) $4.00.

A procedure for the semi-automatic evaluation of swelling from transmission electron micrographs is described. The relevant parameters are measured on a modified Siefert traveling microscope with analogue voltage output. The latter is fed into a Hewlett–Packard digital voltmeter interfaced to a Hewlett–Packard 9810 desk computer. Both void density and void volume are determined in this manner with simultaneous evaluation of mean void volume $\bar{v}$ and standard error on the mean S_M. The method is applicable to all methods of void production but is particularly relevant to the examination of reactor specimens. (auth)

17861 (TI-696-240-080) STRAIN VS. STRAIN RATE RELATIONSHIPS FOR INCOLOY 800, HASTELLOY X AND HASTELLOY N. Davies, N. F. (Atomics International Div., Canoga Park, Calif. (USA)). 18 Nov 1970. 16p. Dep. NTIS $4.00.

Strain versus strain rate data for unirradiated and irradiated Incoloy 800, Hastelloy X, and Hastelloy N were collected and plotted. All readily available data, both biaxial and uniaxial, between 1200 and 1400°F were included regardless of chemistries, heat treatment, aging effects, etc. Several general conclusions were drawn from these data: (1) For unirradiated material, the strain to rupture decreases with decreasing strain rate (below tensile rates). This is also seen in 316 SS. (2) There appears to be a minimum in the curves for uniaxial tests on irradiated material. No such minimum is apparent in the biaxial data. (3) Biaxially stressed specimens (unirradiated) tested at low strain rates give the most accurate prediction of what the stress rupture ductility may be following irradiation. (auth)

17862 (ZJE-159) INFLUENCE OF DEFECTS IN B. C. C. IRON ON SIMULATED LOW-ENERGY DISPLACEMENT CASCADES. Brumovsky, M. (Skoda, Plzen (Czechoslovakia)). 1975. 30p. Dep. NTIS (US Sales Only) $4.50.

The effects of defects in bcc iron on its radiation damage characteristics has been studied by equations of motion numerical integration of a large set of atoms using a high-speed computer. As characteristic the following defects were chosen: vacancy, ⟨100⟩ and ⟨110⟩ split interstitials, and interstitial carbon atoms in octahedral positions. The threshold energy for displacing a carbon atom is found to be highly dependent on direction of the knock-on, similarly as for the case of iron atoms. The lowest threshold energy is found to be less than 3 eV in ⟨100⟩ direction and the highest in ⟨110⟩ direction. Channeling of carbon atoms was observed only in ⟨100⟩ direction. Defects can also influence the dynamics of processes of radiation damage, first of all its collision chains. Vacancies defocus collision chains in ⟨100⟩ and ⟨111⟩ directions. Split interstitials, if not parallel to collision chain, practically stop its propagation. The largest effect is produced by interstitial carbon atoms—they rapidly slow down all types of collision chains. (auth)

17863 INTERACTION OF GAS BUBBLES IN AN ANISOTROPIC ELASTIC SOLID. Willis, J. R. (Bath Univ., Eng.). J. Mech. Phys. Solids.; 23: No. 2, 129-138(Apr 1975).

The problem of finding the stress field induced in the neighborhood of two spherical gas bubbles or voids in an anisotropic matrix is formulated in terms of an integral equation for the "transformation stress" in equivalent homogeneous inclusions. An iterative method of solution is outlined, involving the solution of a class of problems for a single spherical inclusion perturbing a polynomial field of stress. Explicit solutions are obtained for polynomials up to second degree. Estimates of the energy of interaction between gas bubbles in α – U and between voids in Mo are deduced as examples, and the results are discussed in relation to earlier calculations and to observations. (auth)

17864 PULSED THERMO-MAGNETIC EFFECTS IN RARE EARTH COMPOUNDS. Diggle, P. C.; Gehring, H. A. (Oxford Univ.). J. Phys., C (London); 8: No. 9, 1423-1434(7 May 1975).

A pulsed, tuneable dye laser has been used to pump the optical energy levels of single crystals of rare earth compounds. Because of the short relaxation times, this results in fast heating of the crystals. The subsequent changes in magnetization have been recorded and explained using the known magnetic properties. The slow cooling is exponential provided the heat pulses are small and is limited by the Kapitza boundary resistance (varying as T^{-3}) when the helium is superfluid. In normal helium the thermal resistance also varies as T^{-3}. Large heat pulses give anomalous magnetic signals, with very long delay times, and these are interpreted in terms of the formation of a gas film around the crystal surface. (auth)

17865 IRRADIATION-INDUCED DEFORMATION. Gittus, J. (United Kingdom Atomic Energy Authority, Salwick, Eng.). pp 203-273 of Creep, Viscoelasticity, and Creep Fracture in Solids. Gittus, J. London; Applied Science Publishers (1975).

It is pointed out that the phenomenon of radiation-induced deformation is of major importance in the design and operation of nuclear fuel elements and graphite moderators for service in nuclear reactors. The subject is examined from both experimental and theoretical points of view. The review covers uranium, zirconium, stainless steels and nickel-based alloys, UO_2 and other uranium compounds, graphite and carbon. In the sections on theories the following are discussed: "Cottrell" creep, dislocation glide and climb, primary creep, loop nucleation, relaxation in spikes (UO_2), pinning and unpinning of dislocations (graphite). (UK)

17866 DISLOCATION LOOP ORIENTATION IN HELIUM-ION-BOMBARDED NICKEL. Sokursky, Yu. N.; Protsenko, L. N. (Inst. for Inorganic Materials, Moscow). J. Br. Nucl. Energy Soc.; 14: No. 2, 137-143(Apr 1975).

From conference on irradiation behavior of fuel cladding and core component materials; Karlsruhe, Ger. (3 Dec 1974).

Burgers vectors were determined in Ni foil irradiated by ~70-keV He ions to a dose of 10^{16} ion/cm^2 and annealed at 500°C for 5h. The object was to establish the interrelation between the Burgers vectors, foil geometry, and stresses in the foil. Transmission electron microscope studies were made and the Burgers vector determined by analyzing the loop vanishing on "two-beam" photographs taken in the reflections of the type (020), (111), (220), and (113). Photographs of the same foil taken in different reflections are shown. Investigation was made of 220 loops and a summary of the data is presented, with the results discussed in detail. The region studied contained intrinsic dislocation loops mainly in the planes $(\bar{1}1\bar{1})$ with the Burgers vectors (101), $(\bar{1}10)$, $(0\bar{1}1)$. The sample edges were shown to bend around the axis parallel to the sample edge. The bend around the axis perpendicular to the sample edge is made difficult due to the restraining action of the adjacent thicker regions. Stresses thus developed are relieved through the preferential development of loops in planes parallel to the vertical axis. (UK)

17867 STRUCTURAL STABILITY DURING IRRADIATION. Hudson, J. A. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Br. Nucl. Energy Soc.; 14: No. 2, 127-136(Apr 1975).

From conference on irradiation behavior of fuel cladding and component materials; Karlsruhe, Ger. (3 Dec 1974).

In addition to void growth and irradiation creep, these are several other processes which may be brought about or enhanced in an irradiation environment: diffusion; dissolution of precipitates; resolution of gas; disordering and re-ordering; nucleation; formation of new or "wrong" phases; and segregation and morphology changes. Examples are given of these processes acting singly or in some combination, and the structural changes resulting from them are discussed. (UK)

17868 IRRADIATION BEHAVIOR OF FUEL CLADDING AND CORE COMPONENT MATERIALS. KTG/BNES Conference, Karlsruhe, West Germany, 3–5 December 1974. Harries, D. R. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Br. Nucl. Energy Soc.; 14: No. 2, 123-126(Apr 1975).

From conference on irradiation behavior of fuel cladding and component materials; Karlsruhe, Ger. (3 Dec 1974).

A review is presented of the conference on irradiation behavior of fuel cladding and core component materials organized by Kerntechnische Gesellschaft im Deutchen Atomforum and the British Nuclear Energy Society in co-operation with Gesellschaft für Kernforschung mbH, Karlsruhe. There were three principal

sessions covering the topics of void swelling, structural stability, and in-reactor and post-irradiation mechanical properties. Most of the contributions were concerned with materials problems in sodium-cooled fast reactors but there was a small number of papers on zirconium and its alloys used in water and steam-cooled thermal reactors. (auth)

17869 INVESTIGATION OF THE EFFECT OF RADIATION AND HYDROGEN ABSORPTION ON THE STRENGTH AND PLASTICITY UNDER STATIC TENSION OF SPECIMENS OF 12Cr2MoVa (48TS-3) STEEL. Karsikov, E. A. (Moscow Power Inst.). Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 120-121(Jun 1974). Translated from Teploenergetika 21: No. 6, 83(Jun 1974).

The specimens were irradiated with fast neutrons at 180°C. It was found that H adsorption by irradiated specimens leads to increased strength and decreased elongation. Restoration of plastic properties in irradiated specimens takes place slowly. (JRD)

17870 SUPERCONDUCTING PROPERTIES OF Nb12Al3Ge WITH VARIABLE NIOBIUM CONTENT. Ageev, N. V.; Alekseevskii, N. E.; Shamrai, V. F. pp 17-19 of Sverkhprovodiashchie svoistva Nb12A13Ge s peremennym soderzhaniem niobiia. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

17871 X-RAY RADIATION EFFECTS ON SEMICONDUCTOR DEVICES. Chauhan, A. S.; Maheshwari, L. K. (Birla Inst. of Tech. and Science, Pilani, India). Indian J. Pure Appl. Phys.; 13: No. 4, 226-228(Apr 1975).

The results of an experimental study of x-ray radiations on semiconductor devices, including junction diodes, transistors, and integrated circuits, are presented. It is shown that the storage time, (t_s) in passivated diodes increases in the presence of radiations. The collector-to-emitter saturation voltage $V_{CE(sat.)}$ initially increases and then becomes constant. The output drive current capability of integrated circuit logic gates is decreased in the presence of the radiations. It is suggested that the channel formation which takes place in important regions of semiconductor devices subjected to x-ray radiations, predominantly controls the device behavior. (auth)

17872 STOPPING POWERS OF Al, Ti, Fe, Cu, Mo, Ag, Sn, Ta, AND Au FOR 7.2 MeV PROTONS. Ishiwari, R.; Shiomi, N.; Shirai, S. (Nara Women's Univ. (Japan). Dept. of Physics); Uemura, Y. Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 19-39(Jul 1974).

Stopping powers of Al, Ti, Fe, Cu, Mo, Ag, Sn, Ta, and Au for 7.2 MeV protons have been measured using a silicon detector. It has been confirmed that the present results for Al, Cu, Ag, and Au are in good agreement with the previous work. It has been found that Nara data are 1.5 ~ 3 percent lower than the data of Andersen et al. It appears that the deviations are decisive. It has been discussed that Nara data accord with the range data of the compilation of Whaling and of Rybakov as well as the stopping power data of Burkig and MacKenzie at 20 MeV in the absolute scale. It has been also shown that Nara data accord well, as a whole, with the tables of Barkas and Berger. Some remarks have been given on Andersen's experiment and Nara experiment. The Oscillatory behavior of Bloch constant with increasing Z has also been discussed. (auth)

17873 DIRECT EVIDENCE FOR VACANCY CLUSTERING IN ELECTRON-IRRADIATED COPPER BY POSITRON ANNIHILATION. Manti, S.; Triftshäuser, W. (Institut für Festkörperforschung, Kernforschungsanlage Jülich, Jülich, Federal Republic of Germany). Phys. Rev. Lett. 34: No. 25, 1554-1557 (23 June 1975).

Doppler-broadening measurements have been performed on electron-irradiated copper during isochronal annealing. These results together with measurements on quenched gold indicate clearly that vacancies become mobile and form clusters in stage-III annealing. (auth)

17874 PREFERRED SITES OF IMPURITIES IMPLANTED IN Be: LATTICE LOCATION AND QUADRUPOLE INTERACTIONS. Kaufmann, E.N.; Raghavan, P.; Raghavan, R.S. (Bell Laboratories, Murray Hill, New Jersey 07974); Ansaldo, E.J.; Naumann, R.A. Phys. Rev. Lett. 34: No. 25, 1558-1561 (23 June 1975).

The quadrupole interaction of the 247-keV level of ^{111}Cd in a Be host is observed to differ by a factor of 3.4 depending on whether the sample is prepared by the implantation of the parent radioactivities ^{111}Ag or ^{111}In. Ion-channeling measurements have shown this difference to arise from the preference of implanted Ag to reside in substitutional sites and In in the tetrahedral interstitial sites of the Be lattice. (auth)

17875 THIRD-STAGE ANNEALINGS SUBSTRUCTURE OF ELECTRICAL RESISTANCE OF GOLD, SILVER, AND COPPER IRRADIATED BY 5.5-MeV ELECTRONS. Arbuzov, V. L.; Baldin, A. V.; Buzynov, A. E.; Klotsman, S. M.; Matvienko, A. F.; Medvedev, G. V.;Pavlov, V. A. (Inst. of Physics of Metals, Kiev). Fiz. Metal. Metalloved.; 39: No. 3, 622-664(Mar 1975). (In Russian).

Graphs are presented for the derived isochrons of the subject irradiated metals. Determination of the qualitative properties (effective activation energy, order of the reaction) of the individual sub-structural components of the spectra makes it possible to identify these components of the spectra of different metals. (tr-auth)

Other Materials

Refer also to abstracts 16828, 16848, 16849, 16903, 17160, 17168, 17291, 17696, 17803, 17865, 18567, 18735, 19032, 19065, 19106, and 19107.

17876 (BNWL-SA-5289) FUNDAMENTALS OF CORROSION CONTROL DESIGN. Perrigo, L. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 5 Feb 1975. Contract AT(45-1)-1830. 44p. (CONF-750510-1). Dep. NTIS $5.25.

From 9th states corrosion seminar; Pomona, California, USA (6 May 1975).

By applying simple and straightforward principles to the design of systems, buildings and equipment, operational corrosion problems may be reduced or avoided. These corrosion control design principles are concerned with promoting the use of orientation, layout, and configuration to avoid the holdup of solutions, abrupt flow changes, impingement, and stagnant areas. Climatic conditions and terrain are important siting considerations in reducing atmospheric corrosion of buildings and facilities. A determined effort is needed to broaden the understanding of anti-corrosion design measures and principles because these are not widely known and recognized by designers and architects. (auth)

17877 (GA-A-13478) PROPERTY CHANGES IN NEAR-ISOTROPIC GRAPHITES IRRADIATED AT 300° TO 600°C: A LITERATURE SURVEY. Price, R. J. (General Atomic Co., San Diego, Calif. (USA)). 13 Jun 1975. Contract AT(04-3)-167. 28p. Dep. NTIS $4.00.

Irradiation data on graphite at 300 to 600°C are needed to evaluate the useful lifetime of large HTGR replaceable top reflector elements. A literature survey disclosed sufficient data on near-isotropic graphites, mostly from the United Kingdom Atomic Energy Authority (UKAEA) and the Dragon Project, enabling reasonable predictions to be made on the effects of irradiation on graphite dimensions, thermal expansivity, thermal conductivity, Young's modulus, strength, and creep. Recommended design values for these properties are given. (8 figures) (auth)

17878 (JAERI-M-5912) MEASUREMENT OF YOUNG'S MODULUS OF THE HIGH-DENSITY PYROLYTIC CARBON LAYER BY COMPRESSING THE COATED FUEL PARTICLE. Ogawa, K.; Iwamoto, K. (Japan Atomic Energy Research Inst., Tokyo). Dec 1974. 20p. (In Japanese). INIS. NTIS (US Sales Only) $4.00.

Young's modulus of the outmost pyrolytic carbon layer was estimated for five kinds of BISO and two of TRISO fuel particles, with H. Hertz's formula derived by the analysis of compression on two isotropic elastic spheres. For the estimation, compressive tests of the coated particles were performed with a strength testing machine having two differential transformers and a displacement meter. The results of Young's moduli was good for the BISO particles; except some particles showed much smaller values than those given by the three-point bending of PyC plate specimens. For the latter case, therefore, modification of the Hertz formula may be necessary. The values for the TRISO particles were larger than expected, possibly because of underestimation of the contribution by a SiC layer. (auth)

17879 (JAERI-M-5927) DIFFUSION OF ALKALI AND ALKALI EARTH METALS IN VARIOUS GRAPHITES. Kikuchi, T.; Iwamoto, K. (Japan Atomic Energy Research Inst., Tokyo). Dec 1974. 22p. (In Japanese). INIS. NTIS (US Sales Only) $4.25.

The diffusion of strontium in various graphites, such as needle coke and Gilsocoke graphites, was studied by sectioning technique. The diffusion of barium and cesium in two of these graphites was studied in a preliminary experiment. The diffusion coefficients for strontium diffusing in coarse grain graphites are larger than in fine grain graphites. Cesium in graphites undergoes two types of transport. Autoradiograms of strontium diffused into ten kinds of graphites were examined. Strontium transport occurs more easily in the binder than in grains. The dependence of strontium diffusion on the diffusant concentration was studied for two graphites; the diffusion coefficients decrease with its concentration. (auth)

17880 (JAERI-M-5937) THE MEASUREMENT OF GAS PERMEABILITY IN VARIOUS GRAPHITES. Kikuchi, T.; Iwamoto, K. (Japan Atomic Energy Research Inst., Tokyo). Dec 1974. 30p. (In Japanese). INIS. NTIS (US Sales Only) $4.50.

The permeability coefficient, porosity and specific surface area of reactor grade graphites, high purity grade graphites and ordinary graphites were measured and the relations between permeability coefficient and the pore structure observed by electron microscope was studied. The flow of gas through graphite is governed by viscous flow in fine grain graphites and by molecular flow in coarse grain graphites. The diameter of fine pores connecting the large ones in fine grain graphites are large and in coarse grain graphites are small, and the relation between permeability coefficient and porosity is not a simple one. (auth)

17881 (JINR-P14-8436) CORRELATION FOR PROTON SPINS IN MOLECULES OF THE CRYSTALLIZED WATER OF LANTHANUM-MAGNESIUM NITRATE. Taran, Yu. V.; Shapiro, F. L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 9p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The single transmission effect of cold neutrons on the polarized proton target from lanthanum magnesium nitrate monocrystal was measured. Experimental results show the absence of the thermal equilibrium concentration of para-molecules of the crystallized water in the 70%-polarized target. (auth)

17882 (JUL-1153) SURFACE STATE TRANSITION AND SURFACE BAND STRUCTURE OF SILICON. Froitzheim, H.; Ibach, H.; Moench, W. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik). Jan 1975. 19p. Dep NTIS (US Sales Only) $4.00.

17883 (TID/SNA-2061) FINAL REPORT ON PROCESSING OF SIX AGCARB/INTREMOLD III CYLINDERS. Davis, H. O. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). [nd]. 95p. Dep. NTIS $7.75.

Data are presented on processing and physical changes in fiber-reinforced carbonaceous matrix composite materials formed into cylinders. Data are included on viscosity, specific gravity, temperature, mixture ratios, and pressure. The data sheets are filed by process identification number in the fabrication logs. (JRD)

17884 (WANL-TME-1151) HYDROGEN CORROSION OF GRAPHITE MATERIALS AND GRAPHITE REACTOR COMPONENTS. Chi, J. W. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 76p. Dep. NTIS $7.00.

Declassified 10 Sep 1973.

Experimental data in the literature on hydrogen reactions with (or corrosion of) graphite materials have been analyzed in an attempt to better understand the mechanisms of the reactions, and to develop rate equations and reaction velocity constants for engineering analysis. The thermodynamics of the system carbon-hydrogen was studied and lead to the conclusion that in the range of temperatures and pressures of concern in the NERVA reactor, both methane and acetylene reactions must be taken into account. At temperatures below approximately 3800°R, the primary reaction is methane formation; above 3800°R acetylene formation predominates. It was postulated that the rate equations for the methane and acetylene reactions are first order with respect to hydrogen. On this basis, reaction velocity constants were calculated from corrosion data obtained for various graphite materials and a range of experimental conditions: Temperature, 1800 to 6459°R; pressure, .0016 to 1100 psia; and mass flowrate, .07 to .80 lb/in^2-sec. The results, presented on an Arrhenius plot, showed excellent correlations: The activation energies for both fueled and unfueled graphites are the same; there is no significant difference in reaction velocity constants for the unfueled graphite materials; the apparent reaction velocity constants for fueled graphites are higher than those for the unfueled; the activation energy for the acetylene reaction is higher than that for the methane reactions; and the corrosion rate of pyrographite is unique. The higher activation energy observed for the acetylene reaction suggests that if reactors were to be operated at temperatures higher than those presently designed, acetylene formation will be potentially the more serious of the two corrosion reactions. On the basis of the excellent correlations obtained on data taken from a variety of graphite materials and flow geometries, it is felt that the reaction velocity constants recommended can be used with confidence in the analysis and design of NERVA reactors. The effects of radiation and heat of reaction on the rate of corrosion are briefly discussed and further experimental studies suggested. The application of corrosion measurements to high temperature determinations are illustrated, and a simple equation for the calculation of maximum local corrosion rates is given. (auth)

17885 INFLUENCE OF POINT DEFECTS ON THE NUCLEAR QUADRUPOLE RESONANCE OF ^{35}Cl IN $KClO_3$ AND $NaClO_3$. Pelzl, J.; Vargas, H.; Dautreppe, D. (CEA, Grenoble, France). J. Phys. Chem. Solids; 36: No. 7/8, 791-796(Jul 1975).

The nuclear quadrupole resonance of ^{35}Cl was studied in γ-irradiated $NaClO_3$ single crystals and in polycrystalline $KClO_3$ and $NaClO_3$ doped with the substitutional impurities Rb^+ and Ag^+, BrO_3^- respectively. The measurements were carried out at 78 and 298°K. The defects diminish the integral intensity of the resonance signal and cause an increase of the line width and a shift of the line center. The magnitude of these effects depends on the temperature. Using the results of X-ray diffraction and Raman measurements made on the same samples, the observed perturbations of the chlorine-35 NQR signal can be interpreted satisfactorily by means of model of an elastically distorted lattice. (auth)

17886 CHARACTERISTICS OF THE H_{2i}–CENTER IN ELECTRON-IRRADIATED NaF: Li^+ AS DETERMINED BY ESR TECHNIQUES. Plant, W. J. (Naval Research Lab., Washington, DC). J. Phys. Chem. Solids; 36: No. 7/8, 801-813(Jul 1975).

An ESR study shows that a center involving two fluorine interstitials is produced in NaF: Li^+ by electron irradiation near liquid nitrogen temperature. An angular dependence study of the ESR spectrum shows that the defect consists of an F_3^{--} molecular ion. The molecule lies in a {110} plane and is tilted 19.5° from the ⟨100⟩ axis which lies in the plane. Since the defect is produced only in lithium-doped material, it is suggested that the center also contains a lithium impurity. The orientation of the defect and the magnitude of the hyperfine constants indicate that the F_3^{--} molecule replaces a lattice fluorine ion and thus involves two interstitial fluorines. The center is therefore given the designation H_{2i1}^-. The hyperfine parameters of the center are found to have a large temperature dependence which may be interpreted as indicating that the F_3^{--} molecule contracts as the temperature is raised. This behavior may be qualitatively explained by the di-interstitial model of the H_{2i1}^- center. The production characteristics of the center are also found to be consistent with this di-interstitial model. (auth)

17887 OPTICAL CHARGE TRANSFER IN CaF_2:Sm. Kiessling, J.; Scharmann, A. (Univ., Giessen, Ger.). Phys. Status Solidi A.; 29: No. 2, K177-K179(16 Jun 1975).

Photostimulated thermoluminescence (PTL) measurements were made on CaF_2: Sm monocrystals. The crystals were exposed to x rays at 77°K and annealed to 500 to 600°K; after cooling to 77°K in the dark, the crystals were stimulated with uv light. Results show that the PTL glow peaks are connected with high-temperature peaks above 500°K after x-ray excitations, and that they are caused by different charge transfer mechanisms which involve deep electron traps. (DLC)

17888 SMALL SIGNAL ADMITTANCE OF CARBON IMPLANTED p-n DIODES. Howes, M. J.; Morgan, D. V.; Ashburn, P. (Univ. of Leeds, Eng.). Solid-State Electron.; 18: No. 6, 491-497(Jun 1975).

In this paper it is considered how the introduction of radiation damage centers, produced by the implantation of carbon ions, affects the small signal admittance of silicon p-n diodes. Thermally stimulated capacitance measurements are used to obtain the charge states and activation energies of the damage centers. For carbon doses between 1×10^{11} cm^{-2} and 1×10^{12} cm^{-2} two trapping levels are observed with activation energies of $E_t - E_v$ = 0.31 eV and $E_c - E_t$ = 0.37 eV, and for doses between 5×10^{12} cm^{-2} and 5×10^{13} cm^{-2} an extra level appears with an energy of $E_c - E_t$ = 0.25 eV. A study is made of the effects of these damage centers on the small signal capacitance and conductance of the diodes under forward bias. The results are interpreted in terms of a conductivity modulation effect, and it is proposed that this technique yields valuable information on the profile of the damage centers. (auth)

17889 E. P. R. STUDY OF A HOLE-CENTER IN $BaBr_2$:K. Moreno, M. (Santander Univ., Spain). Solid State Commun.; 16: No. 10/11, 1239-1241(1 Jun 1975).

A hole-center was studied by EPR methods in $BaBr_2$:K crystals, x-irradiated at 77°K. This hole-center is not a true Br_2^- center: the unpaired electron interacts also with a third bromine nucleus, the maximum value for this superhyperfine constant being 41 ± 1 G. The geometrical structure of this molecular ion is practically linear. In order to form that center the bromine ions have been slightly turned from their original positions in the $BaBr_2$ lattice. (auth)

17890 SERIES OF HIGH-SENSITIVITY TL PHOSPHORS MADE FROM DIVALENT-METAL SULFATES. Ekstrand, K.E.; Dixon, R.L. (Department of Radiology, The Bowman Gray School of Medicine, Wake Forest University, Winston-Salem, North Carolina 27103). Med. Phys. 2: No. 4, 216-218 (July 1975).

A systematic survey of the thermoluminescence (TL) of rare earth activated sulfates of the form $MeSO_4$:RE was made, where Me denotes a divalent metal and RE the rare earth. $SrSO_4:Tb^{3+}$ and $BaSO_4:Eu^{2+}$ exhibit very high TL efficiency following gamma irradiation, comparable to that of the most sensitive phosphors currently available for TL dosimetry. Due to their relatively high Z, these phosphors could prove useful as quality indicators for personnel dosimetry or for detecting very small exposures of low-energy x rays of a known quality. (auth)

17891 METALLIC SUPERCONDUCTING Si AND Ge PRODUCED BY VAPOR QUENCHING ON Cu. Reale, C. (Centro Ricerche Pellicole Sottili, Metal Lux, Milan, Italy). Appl. Phys. Lett. 27: No. 3, 157-158 (1 Aug 1975).

Fine-grained Si and Ge overlays crystallized in a metastable fcc phase were obtained by vapor quenching at 4.2 K onto microcrystalline Cu films quench-condensed at the same temperature on glass substrates. Measurements of the electrical resistance show that in this abnormal form Si and Ge behave as metals and can become superconductors. On warming, the metallic state keeps up to a critical temperature at which the overlay breaks. The fracture may be attributed to the large increase in volume occurring when the fcc phase transforms to the normal diamond-type semiconducting structure. (auth)

17892 PHOTOSENSITIVITY OF THE ELECTRORADIOGRAPHIC SELENIUM LAYERS FATIGUED BY ROENTGEN IRRADIATION. Varanetskas, I. P.; Montrimas, E. A.; Rakauskas, Yu. K. (Vilnyus State Univ., USSR). Liet. Fiz. Rinkinys; No. 6, 1005-1012(1975). (In Russian).

The restoration process of the photosensitivity of the electroradiographic selenium layers fatigued by x-ray irradiation has been investigated. The regularities of the photosensitivity restoration process have been established, and it has been shown that for thick (over 300μm) layers this process follows the exponential law. The rate of the fatigue restoration is limited by the intensity of the thermal excitation of charge carriers from the deep trapping levels. From the temperature dependence of the restoration of the photosensitivity the activation energy of the deep traps responsible for a fatigue was found to be 0.8 to 0.5 eV if the substrate temperature during the layer evaporation is maintained from 10 to 80°C respectively. It has also been shown that the thermal treatment of selenium layers leads to the considerable increase both of the rate of the fatigue growth and of the absolute magnitude of a fatigue, and also to the faster restoration of the photosensitivity. It has been concluded that these changes in the fatigue process are attributed to the formation of the deep traps with a significantly higher capture cross-section. (auth)

17893 STUDIES ON OPTICAL BLEACHING OF X-RAY IRRADIATED KCl BY THERMOLUMINESCENCE. Gartia, R. K.; Ratnam, V. V. (Indian Inst. of Tech., Kharagpur). Indian J. Pure Appl. Phys.; 13: No. 2, 82-84(Feb 1975).

The optical bleaching characteristics of F-centers in x-ray irradiated KCl crystals have been studied by using thermoluminescence (TL) as the tool. It is found that the bleaching of F-centers takes place in two stages, a rapid stage initially, followed by a slow second stage agreeing with earlier reports based on photoconductivity and optical absorption measurements. Study of the bleaching characteristics of the individual TL peaks shows that these peaks also follow a two-stage bleaching process. There is no correlation between the two stages of F-bleaching with those of formation F-centers. (auth)

17894 DECAY OF THERMOLUMINESCENCE OF TRIPLE ACTIVATED CaS PHOSPHORS. Jain, S. C.; Bhawalker, D. R. (Univ. of Saugar, Sagar, India). Indian J. Pure Appl. Phys.; 13: No. 2, 74-77(Feb 1975).

Decay and thermoluminescence of three series of CaS phosphors activated simultaneously by Mn, Ce, and Sm in each series, have been studied to investigate the effect of one activator in the presence of the other two. The intensity of phosphorescence first decreases, then increases, and finally decreases with increase in concentration of the respective activator, showing concentration quenching of luminescence. Decay has been found to be hyperbolic and follows the power law $I_t = I_o t^{-b}$, where b is found to vary from 0.60 to 1.0 for most of the samples. The values of trap depths evaluated from the glow peak temperature or the shoulder temperature are in close agreement with those obtained from the decay studies, thus confirming the Randall and Wilkins theory of superposition and monomolecular kinetics. The consistent values of trap depths from the two studies, irrespective of the series, indicate that the traps are attributable to the host lattice and that the inclusion of the activators merely modifies the trap distribution. (auth)

17895 VIBRATIONAL ANALYSES OF XY_4Z_2 AND XY_4Z SYSTEMS. Risbud, A. C.; Lele, A. B.; Kale, A. J.; Sathianandan, K. (Univ., Poona, India). Indian J. Pure Appl. Phys.; 13: No. 2, 94-97(Feb 1975).

Normal coordinate analysis of $SnCl_4N_2$, $SnBr_4N_2$, $UCl_4O_2^{-2}$ and $UBr_4O_2^{-2}$ ions all belonging to the D_{4h} symmetry is carried out, following Wilson's F-G matrix method using a generalized valence force field. The B_{2u} fundamental mode which is inactive in both Raman and infrared spectra is calculated to be 112, 57, 215, and 174 cm^{-1} for $SnCl_4N_2$, $SnBr_4N_2$, $UCl_4O_2^{-2}$ and $UBr_4O_2^{-2}$ respectively. Using the analyses on the $SnCl_4N_2$ and $SnBr_4N_2$ ions, normal coordinate calculation is extended to the ions, $SnCl_4N$ and $SnBr_4N$ falling under C_{4v} symmetry. A band assignment is suggested for these ions along with a set of calculated frequencies for the unreported modes. (auth)

17896 INFRARED PROPERTIES AND MORPHOLOGY OF ThF_4 FILMS. Mar, H.Y.B. (Honeywell, Inc., Systems and Research Center, 2600 Ridgway Parkway, Minneapolis, Minnesota 55413); Bernal G., E. J. Vac. Sci. Technol. 12: No. 4, 919-924 (July 1975).

Thorium-fluoride films, approximately 2.5 μm thick, were vacuum evaporated onto substrates of potassium chloride. The ThF_4 was evaporated by electron-beam and resistance-heating techniques. The effect on film properties of substrate temperature and a background pressure of sulfur hexafluoride (SF_6) during deposition were observed. Transmission and reflection spectra were measured from 2 to 200 μm and a CO_2 laser calorimeter was used to measure film absorption at 10.6 μm. Film microstructure was observed by scanning electron microscopy. The SF_6 caused high film absorption and severe cracking. Severe cracking was also caused by low substrate temperature. Electron-beam-evaporated films had lowest absorption. (auth)

17897 TWO-COMPONENT MODEL OF PYROCARBON AND ITS EFFECT ON MATERIAL PARAMETER ANALYSIS. Luhleich, H.; Seeberger, D.; Koizlik, K.; Nickel, N. (Institut für Reaktorwerkstoffe, Kernforschungsanlage 577, Jülich 1, Germany). J. Vac. Sci. Technol. 12: No. 4, 750-753 (July 1975).

The results of static cold-wall pyrolysis and deposition experiments suggest a "two-component model" for pyrocarbon deposition, particularly in fluidized beds. By means of this model it is possible to explain the formation of different structures of pyrocarbon. These structures can be correlated with resultant properties after neutron irradiation. (auth)

17898 SUPERCONDUCTIVITY IN DILUTE ALLOYS OF TaS_2 WITH Fe. Fleming, R.M.; Coleman, R.V. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. Lett. 34: No. 24, 1502-1505 (16 June 1975).

Single crystals of iron-doped TaS_2 grown from sintered powders of composition $Fe_{0.05}-TaS_2$ show a rise in critical temperature to above 3 K and an enhanced anisotropy of H_{c2} which is comparable to that observed in $2H$-TaS_2(pyridine)$_{1/2}$. Single crystals grown from $Fe_{0.05}Ta_{0.95}S_2$ powders are stabilized in the $1T$ phase and are semiconducting at all temperatures below room temperature with no resistive anomaly at 200 K. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

17899 (DOCKET-701729-3) FUEL RECEIVING AND STORAGE STATION. Nuclear Regulatory Commission's Draft Environmental Statement. (Allied-General Nuclear Services, Barnwell, S. C. (USA)). May 1975. 93p. Dep. NTIS $7.75.

A draft of the environmental impact statement for the Barnwell Fuel Receiving and Storage Station is presented. This facility is being constructed on a 1700 acre site about six miles west of the city of Barnwell in Barnwell County, South Carolina. The following topics are discussed: the site, the station, environmental effects of site preparation and station construction, environmental effects of station operation, effluent and environmental monitoring programs, environmental effects of accidents, need for the station, benefit-cost analysis of alternatives, and conclusions. (RCK)

Accountability and Safeguards

Refer also to abstracts 17338 and 17339.

17900 (BNL-20129) ISSUES RELATED TO CHOOSING A GUARD FORCE STRUCTURE. Averbach, C.; Cusack, J.; Green, L.; Higinbotham, W.; Indusi, J.; Marcuse, W.; Weinstock, E. (Brookhaven National Lab., Upton, N. Y. (USA)). 28 May 1975. 11p. (CONF-750608-7). Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

The establishment of a federal security force has been suggested as an additional step to protect nuclear material. The force would be given the responsibility for guarding nuclear facilities and shipments of nuclear materials. A study to identify the issues that are relevant to choosing between the private guard forces that are presently employed by industry or a guard force under federal authority is summarized. To examine the issues which would be relevant, three possible types of security force structures were selected for comparison: a federal force under central authority, a private guard force employed by or under contract to a facility, and a private arrangement to employ local police officers similar to the arrangement for armed guards at airports. The issues were divided into seven categories: (1) legal considerations, (2) liability, (3) staffing and operations, (4) costs, (5) relationship to off-site forces, (6) management and control, and (7) transportation. (auth)

17901 (BNL-20209) MEETING THE CHALLENGE. Higinbotham, W. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 25 Jun 1975. 8p. (CONF-750608-10). Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

National and international activities affecting safeguards, which took place during the last year, are listed. The Institute activities for the same period are briefly reviewed. The view is presented that the problems of international proliferation and of possible terrorist attempts to misuse nuclear materials in the USA cannot be avoided by negative steps such as freezing international shipments or postponing the use of plutonium. These problems must be faced squarely. Institute members understand the nuclear risks and safeguards measures to reduce the risks to acceptably low levels. (auth)

17902 (LA-UR-75-1069) INSTRUMENTATION TECHNIQUES FOR NDA OF FISSILE MATERIAL. Martin, E. R.; Augustson, R. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 54p. (CONF-750644-3). Dep. NTIS $5.75.

From annual conference of the American Society for Engineering Education; Ft. Collins, Colorado, USA (16 Jun 1975).

Methods and instruments used in assaying fissile materials based on passive gamma-ray measurement, passive-neutron measurements, and active-neutron measurements are discussed. (TFD)

17903 (LA-UR-75-1074) NONDESTRUCTIVE ASSAY OF HTGR FUEL RODS. Menlove, H. O. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-ENG-36. 22p. (CONF-750608-8). Dep. NTIS $4.25.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

Performance characteristics of three different radioactive source NDA systems are compared for the assay of HTGR fuel rods and stacks of rods. These systems include the fast neutron Sb-Be assay system, the ^{252}Cf "Shuffler", and the thermal neutron PAPAS assay system. Studies have been made to determine the perturbation on the measurements from particle size, kernel Th/U ratio, thorium content, and hydrogen content. In addition to the total ^{235}U determination, the pellet-to-pellet or rod-to-rod uniformity of HTGR fuel rod stacks has been measured by counting the delayed gamma rays with a NaI through-hole in the PAPAS system. These measurements showed that rod substitutions can be detected easily in a fuel stack, and that detailed information is available on the loading variations in a uniform stack. Using a 1.0 mg ^{252}Cf source, assay rates of 2 to 4 rods/s are possible, thus facilitating measurement of 100 percent of a plant's throughput. (auth)

17904 (LA-UR-75-1078) AUTOMATED NONDESTRUCTIVE ASSAY SYSTEM FOR THE MEASUREMENT OF IRRADIATED ROVER FUEL. Auguston, R. H.; Menlove, H. O.; Smith, D. B.; Bond, A. L.; Durrill, D. C.; Hollowell, W. P.; Bromley, C. P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 16p. (CONF-750608-6). Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

With the termination of the Nuclear Rocket Propulsion (Rover) Program, and associated reactor testing at the Nuclear Rocket Development Station (NRDS), Nevada, plans are progressing to recover the 93 percent enriched uranium contained in irradiated fuel from twenty various test reactors. This fuel is being packaged into 7-cm-dia by 137-cm-long cardboard tubes, using the remote handling facilities (E-MAD Bldg) of NRDS. After packaging, the fuel is shipped to Allied Chemical Corporation, Idaho Falls, Idaho, for uranium recovery. About 4000 tubes will be needed to package and ship the inventory of fuel elements presently at NRDS. This represents a total of approximately 2500 kg of enriched uranium. To complete the accounting records each tube is being nondestructively assayed and records kept on a reactor-by-reactor basis where possible. The assayed values for a reactor are then compared with original input inventory values and discrepancies resolved. The tubes are being assayed by an active neutron interrogation system designed and fabricated by Los Alamos Scientific Laboratory (LASL) and operated by Westinghouse Astronuclear Laboratory (WANL) Nevada Operations personnel. WANL is the operating contractor in charge of loading and shipping this fuel. (auth)

17905 (NUREG-75/060) SPECIAL SAFEGUARDS STUDY. Scopes of Work. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Special Studies). Jun 1975. 50p. NRC.

The Special Safeguards Study (SSS) will be conducted by a combination of (1) contacts with other agencies, (2) NRC staff studies and analysis and (3) contracted studies in specific areas. Most of the study effort will be carried out by contractual support activities. These activities will be devoted to providing technical information, primarily qualitative because of the short term of the study, to enable the staff to determine the most cost-effective sets of measures for plutonium recycle and high-enriched uranium fuel cycle safeguards. The scope of work for these activities is given. The scope of work describes tasks that range from confirming the Commission's safeguards objective to defining specific protection systems for the following siting arrangements: dispersed sites, collocated fuel cycle plants, and mixed parks where reactors, reprocessing plants and fuel fabrication plants are collocated. (TFD)

17906 PROPOSED INCREASE IN THE AMOUNT OF ENRICHED URANIUM WHICH MAY BE DISTRIBUTED TO THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA). House of Representatives, Ninety-Fourth Congress, First Session, February 13, 1975. Washington, DC; Joint Committee on Atomic Energy (1975). 7p. GPO.

The Joint Committee on Atomic Energy, considered H. Con. Res. 115, a resolution expressing the approval of the Congress to the distribution of amounts of special nuclear material to the International Atomic Energy Agency, proposed by the Atomic Energy Commission on January 8, 1975, and reported without amendment the resolution and recommend that the resolution do pass. (TFD)

17907 PROPOSED INCREASE IN THE AMOUNT OF ENRICHED URANIUM WHICH MAY BE DISTRIBUTED TO THE EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM). House of Representatives, Ninety-Fourth Congress, First Session, February 13, 1975. Washington, DC; Joint Committee on Atomic Energy (1975). 8p. GPO.

The Joint Committee on Atomic Energy considered H. Con. Res. 116, a resolution expressing the approval of the Congress to the

distribution of amounts of special nuclear material to EURATOM, proposed by the USAEC on January 8, 1975, and with this document reported the resolution without amendment and recommended that it pass. This report contains sections on background, committee comments, cost, inflationary impact, oversight findings, and budgetary impact. A letter from the chairman of the AEC, Dr. Ray, is included as an appendix. (RWR)

Disposal and Storage

Refer also to abstracts 16937, 16939, 16942, 17461, 18903, 18940, and 19119.

17908 (CONF-740807-P1, pp 293-301) LONG TERM STORAGE TECHNIQUES FOR ^{85}Kr. Foster, B. A.; Pence, D. T.; Staples, B. A. (Allied Chemical Corp., Idaho Falls, ID). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

As new nuclear fuel reprocessing plants go on stream, the collection of fission product ^{85}Kr will be required to avoid potential local release problems and long-term atmospheric buildup. Storage of the collected ^{85}Kr for a period of at least 100 years will be necessary to allow approximately 99.9 percent decay before it is released. A program designed to develop and evaluate proposed methods for long-term storage of ^{85}Kr is discussed, and the results of a preliminary evaluation of three methods, high pressure steel cylinders, zeolite encapsulation, and clathrate inclusion are presented. (auth)

17909 (ORNL-5052) GEOLOGIC DISPOSAL EVALUATION PROGRAM SEMIANNUAL REPORT FOR PERIOD ENDING MARCH 31, 1975. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 135p. Dep. NTIS $7.60.

The Radioactive Waste Repository Project at the Oak Ridge National Laboratory has for some time been engaged in a program directed toward establishing a Federal Repository for radioactive wastes, primarily solidified high-level waste, in a bedded salt formation. Early in 1974, the project was restructured and, to more nearly reflect its broadened scope, was renamed the Geologic Disposal Evaluation (GDE) Program. This report is the first in a series of semiannual progress reports which will be issued to document the progress made in the GDE Program. Most of the subject matter discussed is either geologic or developmental in nature, as would be expected, since the engineering assessment depends on the data generated in these two areas. In addition, since this report also covers the transition period between the Radioactive Waste Repository Project (RWRP) and the GDE Program, information on several RWRP programs, is included. (TFD)

17910 OCEAN DUMPING SITES. Kullenberg, G. E. B. (Univ. of Copenhagen). Ocean Manage.; 2: No. 3, 189-209(Apr 1975).

The marine dumping problem is discussed, defining dumping as an intermittent injection at sea of waste materials. The amount of wastes dumped is fairly limited relative to the total input to the marine environment. Despite this, there has been considerable concern in the last years about dumping, both because of the increasing amounts being dumped and because of growing evidence of disturbances to the environment imposed by certain wastes. This has resulted in two Dumping Conventions which are discussed together with the background development. The types of wastes being dumped are discussed, the importance of a proper analysis before dumping and of keeping wastes from different sources separated is shown. Two basic categories of waste materials are considered, the containerized waste suitable for deposition at the sea floor, and the waste dumped with a view to obtain dispersion. For this category the initial dilution obtainable during the dumping operation is very important. In particular this is the case for wastes which will become submerged since the dispersion in internal layers of the sea can be very weak. Various criteria for selection of dumping sites are discussed, and especially the significance of the physical conditions and their variability is demonstrated. The lack of reliable theoretical models is stressed, e.g., for predicting the depth of penetration of sludge wastes, and the limited scientific knowledge about many of the relevant aspects in general is emphasized. (NL)

Handling Equipment and Procedures

Refer also to abstracts 17150–17154, 17156, 17157, 17162, 17163, and 17182.

17911 (CONF-740807-P2, pp 948-971) TRITIUM EFFLUENT CONTROL LABORATORY. Kershner, C. J.; Bixel, J. C. (Mound Lab., Miamisburg, OH). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A new "Tritium Effluent Control Laboratory" is described. The function of the laboratory is to provide experimental and pilot type facilities for research and development of tritium effluent control systems for recovering tritium from waste gas streams. The goal of the facility is to develop and demonstrate technology and equipment to maintain emissions to the atmosphere below 10 percent of Radioactivity Concentration Guide (RCG) levels. Two helium atmosphere glovebox lines are provided. An air box which interconnects the two helium boxlines is used for equipment transfers and decontamination. In addition, a cryogenic helium purification system services both helium gloveboxes to maintain tritium levels at less than 1 ppm. A catalytic oxidation and oxide adsorption air detritiation system (ADS) traps tritium released to the air box during equipment transfer operations. The air is recirculated for tritium removal before the air box is opened for equipment removal. This system is also used as an effluent treatment system to remove and contain tritium from other miscellaneous laboratory gas streams. Glovebox experiments directed toward the development goal of a closed tritium cycle are described. (auth)

Transportation

17912 (BNWL-B-416) HEAT TRANSFER DESIGN CALCULATIONS FOR INDIVIDUAL SEALED STORAGE CASKS. Burkholder, H. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1975. Contract AT(45-1)-1830. 48p. Dep. NTIS $4.00.

Heat transfer analyses were performed for sealed casks used for the storage of high-level wastes from nuclear power plants. Three kinds of heat transfer calculations were made for individual sealed storage cask units: steady-state analyses during normal operation; transient analyses for the abnormal situation when the natural convection air flow through the annular space between the cask and shield is completely blocked; and transient analyses for burial of an entire unit. The results of these calculations show that the internal temperatures are strongly dependent on canister radius and heat generation rate; almost any canister radius is compatible with the concept if the canister's heat generation rate is low enough; the internal temperatures are almost independent of canister length; and additional metal overpacks around the canister and/or cask increase normal operating temperatures but do not significantly increase temperatures during air flow blockage. If waste acceptance criteria are based on temperatures during flow stoppage, the possible use of shields with fins or spines should be investigated. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

17913 LINEAR ACCELERATORS: THE DEMAND AND THE RESPONSE. Atherton, L. (MEL Equipment Co. Ltd., Sussex, Eng.). Medicamundi; 20: No. 1, 2-11(1975).

The specification for SL75 linear electron accelerators to be used in radiotherapy are outlined. They embody a 90° bending magnet in preference to a 270° magnet in order to reduce the isocentric height, facilitate the selection and stabilization of energies in the electron therapy modes, and stabilize energy in the x-ray modes. The design of the 90° bending magnet and the associated servo-systems represents a reliable solution to the problem of stabilizing field flatness and energy, thereby enabling users to have confidence in the accuracy of their isodose information. Claims that servo-control of these parameters can be dispensed with, by using a 270° acromatic bending system, should be studied with considerable care, especially when made for milti-mode and milti-energy machines. The dual-channel dosimetry feature now generally accepted as essential to safety, and the beam control system of SL75 accelerators anticipates likely future requirements for beam asymmetry warning and energy stabilization. (NL)

17914 SWITCHED LINEAR ACCELERATOR FOR MICROPARTICLES: DESIGN AND COMPUTER SIMULATED PERFORMANCE DATA. McDonnell, J. A.; Haddad, H.; Ashworth, D. G. (Kent Univ., Canterbury, Eng.). J. Phys., E (London); 8: No. 6, 469-474(Jun 1975).

The principles of a novel type of switched linear accelerator for the generation of micrometer sized electrostatically charged particles at hypervelocities in the laboratory are described. A computer technique has been developed for the electrode design, and is also used to derive the potential distribution during particle acceleration. From this the particle trajectories are calculated under the switched discharge sequence. With the computer studies it has been shown that it is possible to achieve longitudinal and radial stability during acceleration using ten stages at 75 kV without beam confinement—this represents an alternative to Van de Graaff electrostatic accelerators. For 120 stages at 75 kV resulting in a performance of 7.5 MV, it has been shown that it is possible to maintain longitudinal stability, but necessary to introduce periodic beam refocusing to maintain radial stability. In the particular type of beam refocusing investigated, it is shown that it is possible to confine the accelerated beam to a radius of 1.5 cm. (auth)

17915 A SUPERCONDUCTING PROTON ACCELERATOR AS AN EXAMPLE FOR APPLICATION OF SUPERCONDUCTIVITY. Citron, A. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Fridericiana. Z. Univ. Karlsruhe.; No. 13, 19-26(Nov 1973). (In German).

8 figs.

The possibility to apply superconductivity for the construction of a proton accelerator is reported. The rf-behavior of the superconductor is discussed, especially the lost power and the preparation of the materials. The problems of superconducting resonator tuning on the hf-transmitter and the helix acceleration method are mentioned. (GE)

Auxiliaries and Components

17916 (INS-TH-86) THE STUDY OF SUPERCONDUCTING CAVITY. Matsumoto, H.; Arai, S.; Katayama, T.; Yoshida, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 25 Oct 1974. 23p. (In Japanese). INIS. NTIS (US Sales Only) $4.25.

The preliminary results of a superconducting cavity study is described. The cavity is designed for a resonance frequency of 2860 MHz and is excited in the TM_{011} mode and is made from bulk niobium. The highest unloaded Q value is 4.3×10^{9} at an input power of 4 watts at the temperature of 1.7°K and the resultant maximum magnetic and electric fields are 92 Gauβ and 3.7 MV/m, respectively. (JA)

17917 (INS-TH-87) HIGH POWER VHF AMPLIFIER. Design and Construction at INS Electron Synchrotron. Katayama, T.; Fukushima, T. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1974. 27p. (In Japanese). INIS. NTIS (US Sales Only) $4.50.

The 20 kW power amplifier at the frequency of 138 MHz was designed and constructed so as to be used for the RF acceleration system at the INS 1.3 GeV electron synchrotron. The 8F68 high power tetrode tube which is widely used at the VHF TV transmitter is suitable for the amplifier. The input and output cavity of amplifier is the coaxial type loaded with the capacitances of the tube. The power of 20 kW is easily obtained and the power level can be controlled with the voltages of the grid and screen grid. The band width also can be changed with the use of a double tuning system. The operation and maintenance are easier than the old one. (auth)

17918 (INS-TH-88) THE SOLID-STATE MASTER OSCILLATOR FOR THE INJECTOR'S MICROWAVE SYSTEM. Tojyo, E. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 19 Nov 1974. 22p. (In Japanese). INIS. NTIS (US Sales Only) $4.25.

A highly stable master oscillator incorporating microwave transistors has been used in place of 3 Watt TWT oscillators and showed an improvement. The acquired short-time stabilities of frequency and c.w. power are within 2×10^{-8} and 4×10^{-3} at 2758 MHz respectively, at temperatures of 20 to 35°C. (JA)

Ion Sources and Injection and Extraction Systems

Refer also to abstracts 18278 and 18326.

17919 (INS-TH-89) PULSE MODULATOR FOR ELECTRON BOMBARDED GUN. Arai, S.; Fukushima, T.; Katayama, T.; Yoshida, K.; Matsumoto, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 25 Nov 1974. 17p. (In Japanese). INIS. NTIS (US Sales Only) $4.00.

An injector linac to the electron synchrotron has been reconstructed. The injection energy of electron beams from the bombarded gun to the new linac has been designed at 100 keV to obtain the best capture efficiency and energy spectrum. In order to operate the electron bombarded gun with 100 keV, a line type pulser and a trifiler pulse transformer with a step up ratio of 10:1 have been made. The pulse of 100 kV height, 4 μsec width is generated with this pulse modulator at a repetition rate of 21 Hz. (auth)

17920 (INS-TH-90) MODEL CAVITY EXPERIMENTS FOR THE ELECTRON LINEAR ACCELERATOR. Katayama, T.; Arai, S.; Morimoto, T.; Yoshida, K.; Tanaka, J. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 10 Nov 1974. 24p. (In Japanese). INIS. NTIS (US Sales Only) $4.25.

An electron linear accelerator for the injector of the electron synchrotron at INS has been constructed. To determine the final sizes of the accelerating structure and to estimate the energy spread of the accelerated electron beam due to the errors of sizes in the course of the fabrication the model cavity experiments have been carried out. Various microwave characteristics of accelerating structures have been obtained experimentally for the many combinations of disks and cylinders. (auth)

17921 (RL-75-046) POSSIBLE TIGNER-TYPE FILLING SCHEMES FOR EPIC. King, N. M. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Mar 1975. 15p.

A summary is given of a proposed injection scheme for a storage ring at Cornell University (Tigner, "Improved Method for Filling an Electron Storage Ring from a Synchrotron" January 1975), involving a sequence of bunch transfers between booster synchrotron and main ring. The whole sequence takes place at the normal main ring injection energy, and is particularly interesting for positron filling. Advantages of using a scheme of this general principle for EPIC are listed. It is pointed out that the basic scheme would need modifying. Detailed discussion follows, under the headings: boxcar stacking in main ring; accretion in wanted bunches; and application to EPIC. (UK)

17922 BETATRON ELECTRON GUN POSITIONING APPARATUS. Yanagisawa, H.; Kuwarai, E. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1973-18994/B/. 20 Mar 1969. 3p. (In Japanese).

The present invention relates to an electron gun positioning apparatus for use in betatrons. The electron orbit adjustment in a conventional betatron has been carried out by adjusting the position of the magnets relative to the betatron, and it has been a very elaborate procedure. The purpose of the present invention is to provide a simple method of electron orbit adjustment in which the position of the electron gun is made externally adjustable. The present apparatus consists of a vacuum junction flange, a

flexible support means which extends inside the betatron with one end connected to the center of the flange, and an electron gun fixed to the support means. The support means can be displaced in the axial direction by externally adjusting a plurality of screws. The setting angle of the support means is adjustable by advancing each of the screws through a different distance. A bellows is employed to provide flexibility of the support means and to prevent leaks in the vacuum chamber. (JA)

17923 ELECTROSTATIC EXTRACTION METHOD AND APPARATUS FOR CYCLOTRONS. Hendry, G. O. (to Cyclotron Corp.). US Patent 3,883,761. 13 May 1975. Filed date 8 Dec 1972. 4p.

A method and apparatus are described for electrostatically extracting high beam currents at improved energy from small dia high magnetic field cyclotrons by deflecting particles from their trajectory within an electrostatic field traversing an extraction channel. Magnetic material immediately adjacent to the inside of at least a portion of the channel first reduces the fringe field and then reverses its normal gradient to assist in extraction and to focus the extracted beam radially with respect to the center of the cyclotron. (Official Gazette)

Ion Optics and Field Calculations

17924 DIFFERENTIAL EQUATION PARTICLE TRACING PROGRAM. Servranckx, R. (Saskatchewan Univ., Saskatoon, Can.). Part. Accel.; 6: No. 2, 83-93(1975).

The need for a particle tracing program, designed for circular particle accelerators and storage rings, which will accept field data as obtained from actual measurements on magnetic elements is stressed. The theoretical study of EROS was perfected by the use of such a program: DEPART. This program does a ray tracing computation by solving the differential equations of motion in an arbitrarily defined field. The underlying theory is given and the choice of the numerical method used for the solution of the differential equations is discussed briefly. Some possible theoretical field expressions suitable to fit measurement data are derived and used in the program. Following is a description of the computations, which refer more specifically to the study of circular machines. The paper ends with the presentation of the program organization and the description of the numerical computations it can perform. (auth)

17925 SOME ASPECTS OF THE DESIGN OF A CYCLOTRON CENTRAL REGION. Nieuwland, J. M.; Hazewindus, N. Philips Res. Rep.; 29: No. 6, 528-559(Dec 1974).

The intensity and the quality of the ion beam accelerated in a cyclotron are often limited by the processes occurring in the central region. These processes are not accessible to a straightforward analytical analysis. Some of the major aspects of this problem are discussed and an explanation of some effects in terms of simple models is presented. A study of the central region of the SIN injector cyclotron is described. A large number of calculations of ion trajectories, using the magnetic-analogue technique to obtain the electric-field distribution, has been carried out for this accelerator. These calculations revealed a number of general aspects which are discussed. The problem of the orbit calculations is discussed in general terms. Various effects which occur in the horizontal motion of the particles are described in more detail. These effects concern the first-gap transition, the orbit-center spread, the eccentricity and the instability. The major topics of the vertical motion are treated extensively, i.e., the vertical focusing, the calculation of the acceptance, the eigen ellipses and the effect of magnetic-field disturbances. (NL)

17926 COHERENT PHASE OSCILLATIONS OF ELECTRONS IN A SYNCHROTRON. Nikitin, M.M. (Scientific-Research Institute of Nuclear Physics, Electronics, and Automation, Tomsk). Sov. Phys.–Tech. Phys. 19: No. 12, 1633-1634 (June 1975).

An experimental study is reported of coherent phase oscillations of the center of gravity of an electron beam in a synchrotron. Differences in the interaction of the accelerated bunches with the accelerating system are indicated. Low-frequency relaxation of the bunches is observed. The particle loss caused by the beam oscillations can be eliminated by adjusting the frequencies of the resonator and the rf source. (auth)

Experimental Facilities

17927 HEAVY-ION ACCELERATORS AND PREDICTED LIFETIMES OF HIGHLY STRIPPED IONS. Sinanoglu, O.; Luken, W. (Yale Univ., New Haven). Comments At. Mol. Phys.; 4: No. 5, 139-145(Sep 1973).

A method which includes both relativistic and electron correlation effects is developed for calculating wavelengths, oscillator strengths, and lifetimes of inshell electronic transitions in highly ionized heavy atoms. Application of the method to the five electron ions indicates that the dependence of oscillator strengths on atomic number is very different than previously assumed. Many lifetimes predicted by this method fall into the range which can be measured using SUPER-HILAC and tandem Van de Graaff accelerators and beam-foil spectroscopy. (15 references) (auth)

17928 CURRENT STATUS OF DT TARGETS FOR CANCER THERAPY. Kelsey, C.A. (Radiology Department, University of Wisconsin Medical School, Madison, Wisconsin 53706). Med. Phys. 2: No. 4, 185-190 (July 1975).

The current status of DT targets for cancer therapy is reviewed with regard to beam composition and energy as well as target configuration, lifetime, and neutron output. The advantages and shortcomings of the various target designs are discussed. It is concluded that several approaches can provide the necessary dose rate and target lifetime for clinical therapy purposes. (auth)

17929 PREPARATION OF RADIOELEMENTS IN A CYCLOTRON. Rev. IRE; 1: No. 3/4, 25(Dec 1974). (In French).

The advantages of the use of a cyclotron for the preparation of radioisotopes are summarized. The properties of the cyclotron at Louvain-laNeuve are described and its use in the weekly preparation of ^{123}I for medical purposes is reported. (JSR)

17930 ELECTRON BEAM GENERATING APPARATUS. Shimizu, Y. (to Matsushita Electric Industrial Co. Ltd., Kadoma, Osaka (Japan)). Japanese Patent 1973-29439/B/. 26 Nov 1970. 3p. (In Japanese).

It is known that prior electron beam irradiating apparatuses leave a disadvantage wherein an electron beam source must be moved upward and downward relative to an article to be irradiated in response to the varying thickness of the article. The novel electron irradiation apparatus of the present invention is characterized in that a plurality of irradiation windows are disposed around the perimeter of a window mounting box, with each window at a different radial distance from the center of the electron source. The irradiating window mounting box may be rotated so that one of the irradiating windows can be suitably located between the electron source and the article in response to the thickness of the article. (JA)

17931 ELECTRON BEAM IRRADIATING APPARATUS. Shinohara, K. (to Matsushita Electric Industrial Co. Ltd., Kadoma, Osaka (Japan)). Japanese Patent 1973-21400/B/. 11 Dec 1968. 2p. (In Japanese).

The present invention relates to an electron beam irradiator in which the irradiation window is eliminated. In the conventional electron beam irradiator, an irradiation window is provided to maintain a vacuum (1×10^{-5} Torr) inside the accelerator. In such a configuration, the electrons suffer great energy loss when they pass through the window. In the present apparatus, an electromagnetic lens system is added to the accelerating system. The electron beam is finely collimated by the electromagnetic lens system and passes through the small slit ($1mm^{\phi}$) into the atmosphere. Thus, the accelerating tube in the present apparatus is communicated to the atmospheric environment. The accelerating tube is now kept in vacuum (10^{-5} Torr) by being continuously exhausted by a large capacity vacuum pump. (JA)

17932 ELECTRON BEAM IRRADIATOR. Shinohara, K. (to Matsushita Electric Industrial Co. Ltd., Kadoma, Osaka (Japan)). Japanese Patent 1973-18999/B/. 24 Jul 1969. 3p. (In Japanese).

The present invention relates to the cooling mechanism for the irradiation window of an electron beam irradiator. The output power of an electron beam irradiator is limited mainly by the technique used for cooling the irradiation window which is heated by the electron beam. In a conventional cooling system, an air jet is blown parallel to the window plane, by which thermal energy is removed. But such a system is not suited in cases where dust due to atmospheric disturbances is undesirable. The present apparatus employs Peltier elements placed on the surface of the window. Most of the electron beam passes through the window, but a portion of it strikes one end of the Peltier element. Since the other end of the element is grounded, an electric current flows through the element, by which cooling of the window takes place. In this manner, the present invention is characterized by utilizing a portion of the electron beam to cool the window. When the intensity of the beam is increased, the electric current flowing through the elements increases, thereby intensifying the cooling of the window. (JA)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

17933 (JPRS-63186) SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE. No. 334. Translation of Unidentified Russian Articles from Various Journals. 28p. NTIS $3.75.

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports, plus published details of Soviet space "spectaculars" are included. (GRA)

Cosmic Radiation

Refer also to abstracts 17282, 18076, 18112, 18180, and 18214.

17934 (AD/A-001025) GEOPHYSICS AND SPACE DATA BULLETIN. Volume 11, Number 2. Second Quarter, 1974. Special Report. Carrigan, A. L. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). Sep 1974. 282p. (AFCRL-SR-183; AFCRL-TR-74-0448). NTIS $8.75.

This bulletin is a quarterly publication that contains AFCRL contract and inhouse data reported from sites throughout the world. The following types of data are contained within each issue: magnetometer, cosmic ray, elf noise, riometer, solar optical and radio emission, and ionosonde. This issue covers such data for April, May, and June 1974. (GRA)

17935 OBSERVATIONS OF LOW ENERGY GAMMA-RAY BURSTS WITH SAS-2. Oegelman, H.; Fichtel, C. E.; Kniffen, D. A. (National Aeronautics and Space Administration, Greenbelt, MD). Nature (London).; 255: No. 5505, 208-210(15 May 1975).

Low energy γ-ray bursts observed by the plastic scintillator anticoincidence dome of the Small Astronomy Satellite-2 (SAS-2) γ-ray telescope are reported. A description of this instrument is given. The average effective threshold for detection over the dome is about 0.15 MeV and the average efficiency rises to about 20% at 0.6 MeV. The counting rate of the dome was accumulated and read out every 768 ms. The satellite was launched in November 1972 into an equatorial orbit, and experimental operation continued until June 1973. The counting rate provided a continuous monitor for fluctuations of the low energy γ-ray fluxes, and a search was made for sudden rate increases. Two events that had been observed by other satellites were detected, together with one event that has since been confirmed by other satellite observations. In addition two events seen by other satellites were not observed by SAS-2. All five of these events are discussed. (UK)

17936 CALCULATIONS OF THE TIME STRUCTURE OF INCIDENCE OF EXTENSIVE AIR SHOWERS. Lapikens, J. (Leeds Univ., Eng.). J. Phys., A (London); 8: No. 5, 838-852 (May 1975).

A series of model calculations is described and the results for average proton-initiated extensive air showers of about 10^{18} eV are compared with those of other model calculations and with a wide range of experimental data including the work of Watson and Wilson (J. Phys. A. Math. Nucl. Gen.; 7: 1199-212 (1974)) on the time structure of the shower front of EAS. Particular care has been taken to allow the model calculations to be matched with the experimental data, and the conclusion of those authors that protons are present in the primary cosmic ray beam at about 10^{18} eV is supported. Further work is suggested to test whether the fluctuations found experimentally can be explained on other hypotheses. (auth)

17937 RECENT EXPERIMENTS TO DETECT ADVANCED RADIATION. Davies, P. C. W. (King's Coll., London). J. Phys., A (London); 8: No. 2, 272-280(Feb 1975).

Inconsistencies in the usual interpretation of the absorber theory of radiation are exposed which invalidate an experiment proposed recently by Heron and Pegg. An earlier experiment by Partridge necessarily gave a null result owing to absorption on the far side of the Earth of any advanced radiation which may have been present. (auth)

17938 ADIABATIC HAMILTONIAN OF CHARGED PARTICLE MOTION IN A DIPOLE FIELD. Chen, A. J.; Stern, D. P. (Goddard Space Flight Center, Greenbelt, MD). J. Geophy. Res.; 80: No. 4, 690-693(1 Feb 1975).

Northrop and Teller have shown that when the guiding center motion of a magnetically trapped particle is averaged over its two fastest periodic modes, the result can be described by a Hamiltonian function, the Euler potentials (alpha,beta) of the particle's guiding field line serving as canonical variables. In the present work the form of this Hamiltonian is developed for a dipole field, and the result is expressed by an analytic approximation accurate within about 1 percent. This allows extension of results derived for equatorial particles to particles with arbitrary pitch angles; in particular, it makes available even in the presence of electric fields orthogonal to the magnetic field a function K that is preserved by the bounce-averaged motion. This function provides at once the equations of drift paths in (alpha,beta), or of their projections onto the equatorial plane; the derivation of a "pacing function" u that times the progress of particles along such drift paths will also be described. Other applications include the derivation of accurate approximations of the mean drift velocity, the energization of electrically convected particles, and the "bounce time" T. (auth)

17939 WHERE ARE THEY NOW. Cosmic Rays From Supernovae. Higdon, J. C. Los Angeles; Univ. of California (1974). 144p. University Microfilms Order No. 75-9395.

Thesis (Ph. D.).

This thesis investigates whether it is possible to observe the early stages of cosmic ray propagation near young supernova remnants. Various radiation processes are investigated: nuclear interaction, bremsstrahlung, and Compton scattering. It is found that the most likely process by which such cosmic ray cloud could be detected is gamma-ray emission through pion production. Diffusive models for propagation are used to calculate the gamma-ray radiation from various possible diffuse cosmic ray clouds in the vicinity of known supernova remnants. SAS-2 observations of the Vela region show an excess gamma-ray intensity of about $5^{*}10^{-6}$ $(cm^2\text{-}sec)^{-1}$ greater than 100 MeV. Comparing this flux excess with that calculated for gamma-rays from a diffuse cosmic ray cloud suggest that about $1^{*}10^{51}$ ergs may have been produced in the Vela supernova. Such a total cosmic ray energy release means that either only a fraction of supernovae produce cosmic rays or only a small fraction of the mean path length of the cosmic rays is traversed in the interstellar medium. The angular resolution of the flux excess is consistent with diffusive propagation. (Diss. Abstr. Int., B)

17940 HIGH-ENERGY GAMMA-RAY RESULTS FROM THE SECOND SMALL ASTRONOMY SATELLITE. Fichtel, C.E.; Hartman, R.C.; Kniffen, D.A.; Thompson, D.J.; Bignami, G.F. (NASA/Goddard Space Flight Center, Greenbelt, Maryland); Ögelman, H.; Özel, M.E.; Tümer, T. Astrophys. J. 198: No. 1, 163-182 (15 May 1975).

A high-energy (>35 MeV) γ-ray telescope employing a 32-level wire spark-chamber system was flown on the second Small Astronomy Satellite (SAS−2). The high-energy galactic γ-radiation is observed to dominate over the general diffuse radiation along the entire galactic plane and is seen to be most pronounced in a region from l^{II} 335° to l^{II} = 40°. When examined in detail, the longitudinal and latitudinal distributions seem generally correlated with galactic structural features, and particularly with arm segments. On the basis principally of its angular distribution and magnitude, the general high-energy γ-radiation from the galactic plane seems to be explained best as resulting primarily from cosmic-ray interactions with interstellar matter. From the study of six different regions of the sky with $|b^{II}| > 30°$, there appears to be a uniform celestial γ-radiation, as suggested by earlier results, especially Kraushaar *et al.* Over the energy range from about 35 MeV to 170 MeV, the differential spectrum has the form $dJ/dE = (2.7 \pm 0.5) \times 10^{-7}(E/100)^{-2.4 \pm 0.2}$ γ-rays cm^{-2} sr^{-1} s^{-1} MeV^{-1}, where E is expressed in MeV. If the apparent flattening of the spectrum in the 0.6−10 MeV region observed in other experiments is verified, the high-energy results reported here, when combined with the lower-energy data, suggest a cosmological origin for this radiation. In addition to the general galactic emission, high-energy γ-radiation was seen from the Crab Nebula (a significant fraction of which is pulsed at the radio pulsar frequency), Vela X (a supernova remnant whose high-energy γ-radiation possibly provides the first direct experimental evidence associating cosmic rays with supernovae), the general region ($15° < b^{II} < 30°, 340° < l^{II} < 20°$), and a region a few degrees north of the galactic plane around 190° to 195° in l^{II}. Several upper limits to high-energy γ-rays fluxes were also set, including among others, above 100 MeV: 1.0×10^{-6} for the Small Magellanic Cloud, 9.5×10^{-7} for Sco X−1, 2.5×10^{-6} for 3C 120, 1.0×10^{-6} for M87, and 1.1×10^{-6} for Cas A in units of photons $(E > 100\ MeV)/(cm^2\ s)$. (auth)

17941 APOLLO 17 COSMIC-RAY EXPERIMENT: INTERPLANETARY HEAVY NUCLEI OF ENERGIES 0.05 TO 5.0 MeV PER ATOMIC MASS UNIT. Woods, R.T.; Hart, H.R. Jr.; Fleischer, R.L. (General Electric Research and Development Center, Schenectady, New York). Astrophys. J. 198: No. 1, 183-194 (15 May 1975).

Glass detectors were exposed to interplanetary heavy ions for 45.5 hr on the Moon during 1972 December 12 and 13. In the energy range 0.5–5.0 MeV amu^{-1}, the differential flux of iron-group nuclei was found to be a power-law spectrum of the form E^{-3}. During the experiment, solar activity was low, as inferred from both ground-based observations of solar activity and satellite measurements of particles in interplanetary space. The Fe/α ratio at ~1 MeV amu^{-1} was enhanced by a factor of ~10 above the solar ratio. A pair of detectors that were exposed in both the solar and antisolar directions gave identical spectral shapes, with the flux from the solar direction being twice that from the antisolar direction. Collectively, the observations of solar-related anisotropy and the E^{-3} spectra, and the factor of ~10 enhancement in the Fe/α ratio, imply strongly that these heavy ions are solar in origin. (auth)

17942 GALACTIC GAMMA RAYS FROM THE SUPERPOSITION OF X-RAY SOURCES. Fusco-Femiano, R. (Consiglio Nazionale delle Richerche, Frascati, Italy). Nature (London); 254: No. 5496, 125-126(13 Mar 1975).

It is stated that satellite observations have shown an enhanced flux of high energy photons (>30 MeV) along the galactic plane. The intensity shows a broad and flat maximum extending about 60° around the galactic centre. The average value of the flux in the central region is $(1.1 \pm 0.3) \times 10^{-4}$ photons per cm^2 per sr, and in the anticenter is about a factor of five less. The energy spectrum in the range 35 to 210 MeV is quite flat, and may indicate that the γ-rays arise from decay of π^0 mesons. Various models have been proposed to account for this flux in terms of collisions between cosmic rays and interstellar matter. Observations of γ-rays would give important indications regarding the distribution of matter and cosmic rays. The distribution of γ-rays resembles the distribution of x-ray sources, and the γ-ray flux may result from the superposition of sources rather than having a diffuse origin. The problem is here reconsidered. It is considered premature, however, to conclude that the observed γ-ray flux is the result of a superposition of sources rather than cosmic ray collisions. (UK)

17943 SEASONING OF LATENT DAMAGE TRAILS IN LUNAR SAMPLES. Khan, H. A.; Ahmad, I. (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). Nature (London); 254: No. 5496, 126-127(13 Mar 1975).

It is stated that lunar samples analysed by charged particle track techniques show track parameters of Fe group nuclei that are very different from those produced by ^{56}Fe ions in laboratory simulation experiments; for example, they are more stable. Similar effects are expected for other charged particle tracks. It seems as though latent damage trails in lunar samples have been subjected to what is termed "seasoning", that is, their structures have been modified by lunar conditions (particularly lunar temperature and high doses of light charged particles). A laboratory study is described of the relative roles of temperature and time in this "seasoning" process. Attempts were made to "season" or "stabilise" latent damage trails by annealing samples under various combinations of temperature and time intervals. A comparison was also made to compare the annealing properties of "seasoned" and "unseasoned" damage trails. A large piece of tektite glass was irradiated with thermal neutrons to cause fission of U present as impurity; a uniform track density of about 10^6 tracks/cm^2 was found. Small portions were then annealed at temperatures up to 550° for time intervals varying from 2 min upwards, the object being to study the track annealing properties, including difference between long and short term annealings, simulating the production of "seasoned" and "unseasoned" tracks. (UK)

17944 ORIGIN OF MAGNETITE AND PYRRHOTITE IN CARBONACEOUS CHONDRITES. Herndon, J. M.; Rowe, M. W.; Larson, E. E.; Watson, D. E. (Texas Agricultural and Mechanical Univ., College Station). Nature(London); 253: No. 5492, 516-518(13 Feb 1975).

It is suggested that a substantial fraction of the magnetite present in some carbonaceous chondrites resulted from the oxidation of troilite, and that pyrrhotite is to be expected as a direct consequence of magnetite formation through this reaction. Meteoritic magnetite was previously considered to have resulted from the oxidation of metallic Fe or from the alteration of olivine. The formation of magnetite from troilite has been observed in laboratory experimental work, but despite the ubiquitous presence of troilite in chondritic meteorites very few studies of its stability and the possibility of its oxidation have been made, but it is known that above 413K troilite is converted to hexagonal low temperature pyrrhotite, and at temperatures as low as 373°K magnetite is formed provided the troilite is sufficiently finely divided. If meteoritic magnetite resulted from the oxidation of troilite the reaction must have been able to occur under conditions expected in the early solar system, and petrological evidence must be compatible with the expected consequences. These factors are discussed on the basis of O_2 and other element fugacity considerations. Calculations demonstrate that magnetite formation from condensed troilite is possible at temperatures at which it has been determined that troilite can readily undergo oxidation. (UK)

17945 ENERGY SPECTRUM OF DIFFUSE COMPONENT OF COSMIC SOFT γ RAYS. Fukada, Y.; Hayakawa, S.; Kasahara, I.; Makino, F.; Tanakay, Y.; Sreekantan, B. V. (Nagoya Univ., Japan). Nature (London); 254: No. 5499, 398-399(3 Apr 1975).

Some new measurements are described on the diffuse component of cosmic soft γ-rays in the energy range 0.1 to 4 MeV. The measurements were made with a balloon-borne telescope, and showed that the energy spectrum gradually steepens as the energy increases from 100 to 500 keV and then becomes less steep; this is consistent with the presence of a "hump" in the MeV region. Difficulties associated with previous observations at balloon altitudes and from spacecraft were circumvented by employing the "active shutter method". Details are given of the experimental set-up. The apparatus was flown from Hyderabad in April 1974. Comparisons are made with earlier results. (UK)

17946 SPECTRUM OF THE SOLAR DAILY VARIATION OF COSMIC RAYS IN THE HIGH-ENERGY REGION. Bishara, A. A.; Dorman, L. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 486-490(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 573-578(1974).

The energy spectrum of the solar daily variations of cosmic rays in the high-energy region is found from underground observations. The results obtained are interpreted on the basis of the theory of anisotropic cosmic-ray diffusion in interplanetary space and of data on the sector structure of the interplanetary magnetic field. (5 tables, 2 figures) (auth)

17947 CHANGE IN THE INTENSITY OF COSMIC RAYS, SOLAR AND GEOMAGNETIC ACTIVITY, TIDAL FORCES, AND OF THE CENTER OF MASS OF THE SYSTEM OF INNER PLANETS WITH TIME. Kolomevets, E. V.; Mukanov, Zh. B.; Shakhova, Yu. A.; Shvartsman, Ya. E. (Kazakh State Univ., Alma-Ata, USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 618-620(1974).

The frequency spectra of variations in the intensity of cosmic rays, solar and geomagnetic activity, and of tidal forces from the inner planets of the solar system, except Jupiter, and the parameters describing distance, velocity, acceleration, and rate of change of the acceleration of the center of mass of the planets with respect to the center of the sun with periods of 40 days to 11 years have been studied. From the data, it is concluded that there are variations in cosmic rays and solar and geomagnetic activity with periods coinciding with the periods of the planets. (1 table, 2 figures) (SDF)

17948 A PHENOMENOLOGICAL STUDY OF COSMIC RAY PROPAGATION. A Corrected Diffusion Model. Le Guet, F. (Observatoire de Nice, 06 (France)); Stanton, M. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Departamento de Informatica). Astron. Astrophys.; 35: No. 2, 165-169(Oct 1974).

It is shown that the mathematical solution of the transfer equation given by Le Guet and Pacheco (1973) for the propagation of cosmic nuclei is incorrect. The correction is given, and it is found that in certain cases the diffusion coefficient can differ by about an order of magnitude from that obtained previously. (auth)

17949 MEASUREMENTS OF ALTITUDE AND LATITUDE VARIATIONS OF NEUTRON INTENSITY BY A LARGE BF_3 COUNTER ABOARD AN AIRCRAFT. Kawasaki, S.; Wada, M. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Sci. Pap. Inst. Phys. Chem. Res. (Jap.); 68: No. 2, 31-37(Aug 1974).

A large BF_3 proportional counter surrounded by polyethylene 2 cm thick, which is generally used for the super-neutron monitor, was boarded on an aircraft on October 14, 1973. The altitude variation up to 244 g/cm^2 along the vertical cutoff rigidity of 12 GV and the latitude variations at the levels of 244 and 268 g/cm^2 for the rigidities between 7 and 15 GV were obtained. The results are compared with those of Kodama and Suda's observations by counters with a lead producer performed in the same rigidity region in 1964 to 1965. Also compared are the Monte Carlo calculations recently reported by New York University group. The relative shapes of their curves for 1 to 10-MeV neutrons coincide with the present results well for both the altitude and latitude variations. The pressure coefficient as a function of altitude is consistent with that observed at lower rigidity regions. A possible

air-ground boundary effect was detected for the altitudes lower than 950 g/cm^2 level. (auth)

17950 THE ORIGIN OF COSMIC RAYS AND THE VELA GAMMA-RAY EXCESS. Higdon, J.C. (Department of Planetary and Space Science, University of California, Los Angeles); Lingenfelter, R.E. Astrophys. J. Lett. 198: No. 1, L17-L20 (15 May 1975).

The recent observation of excess γ-ray emission from the region around the Vela supernova remnant provides the most direct evidence so that supernovae produce sufficient energy in relativistic particles to be the source of cosmic rays. We show than an estimate of the cosmic ray energy around Vela suggests that either only a fraction of galactic supernovae are the source of most cosmic rays, or only a fraction of the matter traversed by cosmic rays is in the interstellar medium. (auth)

17951 FLUCTUATION EFFECTS ON DIRECTIONAL DATA. Linsley, J. (Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico 87131). Phys. Rev. Lett. 34: No. 24, 1530-1533 (16 June 1975).

The problem addressed is that of determining best values and confidence limits for the amplitude and phase of an unknown harmonic amplitude vector, given a single set of directions measured on a circle. The previously known solution, for the limiting case of small fluctuation, is inapplicable to the great majority of cosmic-ray anisotropy measurements. Solutions are given that are thought to be valid for all cases likely to occur in practice. (auth)

Stars

Refer also to abstracts 17939, 18035, 18037, 18060, 18108, 18131, 18300, 18380, and 18383.

17952 (IC-73-147) JOURNEY TO THE CENTRE OF A NEUTRON STAR. Chitre, S. M. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1973. 11p. INIS.

The physics of the interior of a neutron star is summarized starting from the surface through to the central regions. The problem regarding the existence of a solid core inside a heavy neutron star is critically reviewed and its astrophysical implications are briefly discussed. (INIS)

17953 (N-74-35245) HIGH ANGULAR RESOLUTION COSMIC X-RAY ASTRONOMY OBSERVATIONS IN THE ENERGY RANGE 0.15 TO 2 keV AND XUV OBSERVATIONS OF NEARBY STARS FROM AN ATTITUDE CONTROLLED ROCKET. Annual Report, 1 September 1973--31 August 1974. Garmire, G. P. (California Inst. of Tech., Pasadena (USA)). 31 Aug 1974. 46p. NTIS $5.50.

The construction of a two dimensional focusing Wolter Type I mirror system for X-ray and xuv astronomical observations from an Astrobee F sounding rocket is described. The mirror design goal will have a one degree field, a 20-arc seconds resolution, an effective area of about 50 sq cm at 1 keV and 10 sq cm at 0.25 keV on axis. A star camera provides aspect data to about 15-arc seconds. Two detectors are placed at the focus with an interchange mechanism to allow a detector change during flight. The following specific developments are reported: position sensitive proportional counter development; channel plate multiplier development; telescope mirror development and payload structure; Australian rocket flight results; Comet Kohoutek He I observation; and Vela, Puppis A, and Gem-Mon bright patch observations. (auth)

17954 (N-75-10882) INFRARED, RADIO, AND X-RAY OBSERVATIONS OF CYGNUS X-3. Becklin, E. E.; Hawkins, F. J.; Mason, K. O.; Matthews, K.; Neugebauer, G.; Packman, D.; Sanford, P. W.; Schupler, B.; Stark, A.; Wynn-Williams, C. G. (Hale Observatories, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 25p. (NASA-CR-140680; AD-784439). NTIS $3.25.

The x-ray source Cygnus X-3 has been interpreted as being a binary system on the basis of extensive x-ray observations of periodic variability. At radio wavelengths, the source displays erratic outbursts. Cyg x-3 has not been detected visually but at infrared wavelengths periodic variations in phase with the x-ray variations have been reported. Infrared, x-ray and radio observations of Cyg X-3 made during 1973 through 1973 October are presented. (GRA)

17955 (UCRL-51832) STRUCTURE OF STRONG SHOCK WAVES: WITH IMPLICATIONS FOR DEUTERIUM SYNTHESIS IN SUPERNOVAE. Weaver, T. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 May 1975. Contract W-7405-eng-48. 180p. Dep. NTIS $7.60.

Thesis.

The structure of strong shock waves is calculated over the range of shock energies (1 to 100 MeV/nucleon) and initial number densities (10^{18}–10^{22} cm^{-3}) believed likely to occur in the red-giant-like envelopes of stars undergoing type II supernovae explosions. The general equations governing the structure of such shocks are developed on the basis of a hydrodynamic treatment of a plasma composed of ions, electrons, positrons, and photons, making use of diffusion theory to evaluate the dissipative and transfer terms. Several strong shock structure models are formulated and solved on the basis of these equations and physical processes. A shock model dominated by radiation pressure and transport is considered and criteria for its self consistency deduced. For electron temperatures above approximately 70 keV, the gamma gamma reversible e^+e^- reaction is found to give rise to a sufficient number of pairs to cause the principal source of shock dissipation to shift from radiative heat transport to ion-lepton Coulomb friction. The properties of such a pair-dominated model are discussed. The stability of radiation-dominated shocks and the lack of self-consistent hot-ion shocks is demonstrated. This demonstration leads to the conclusion that peak shock temperatures remain low enough to preclude production of a cosmologically significant amount of deuterium in supernova shock waves. The application of these concepts is considered. (GHT)

17956 (UCRL-75221) SCREENING FACTORS IN LATE STELLAR EVOLUTION. Graboske, H. C. Jr.; DeWitt, H. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov 1973. 5p. (CONF-7309140-1). Dep. NTIS $4.00.

From IAU symposium on late stages of stellar evolution; Torun, Poland (5 Sep 1973).

Recent studies have modified the screening factors for nuclear reactions and current studies of screening have verified the accuracy of the general screening function relation for a wider range of physical conditions. Extensive Monte Carlo calculations have considerably extended and improved the accuracy of the numerical data used to determine the screening function. The effect on the screening of nonuniform electron distributions has been investigated. The effect on screening of electron clumping around the reacting nuclei has been determined. Results show significant enhancement of the screening function over the uniform distribution results. (BJG)

17957 GRAVITATIONAL CONTRACTION OF PROSTARS. IV. The Opaque Core Formation. Kolesnik, I. G. (Glavnaya Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 26, 24-37(1975). (In Russian).

For the protostar with M = 1 M, $R_0 = 10^6$ R and cooling by dust grains the opaque core formation is considered. The changes in the core characteristic with time are calculated. The protostar core mass is about 0.025 M_0. The final mass of the star is supposed not to exceed 0.1 M_0. (8 refs, 15 figs) (auth)

17958 PHOTOMETRY OF THREE VARIABLES IN THE NEIGHBORHOOD OF GALACTIC CLUSTER NGC 6830. Shaganyan, B. L.; Vypirailo, I. I. (Kherson Pedagogical Inst., Kiev). Astrometriya Astrofiz.; No. 26, 63-68(1975). (In Russian).

The results are given of photographic observations of LZ, NS and V 781 Agl in the neighbourhood of the galactic cluster NGC 6830. The stellar brightness was estimated by the Neuland-Blazhko method, using the plates from the collection of the Shternberg State Astronomical Institute. The stellar magnitudes of comparison stars are tied to the Grubisich standard system placed in the same cluster. The correction for the field error was not made. The maps of neighbourhood of each variable, photographic values of comparison stars and epochs of maximum light are presented. The seasonal curves of light variations in the spectrum photographic region are obtained. (5 refs, 6 figs, 3 tables) (auth)

17959 SPECTRAL CLASSIFICATION OF LATE-TYPE STARS OF OXYGEN SEQUENCE. Komarov, N. S.; Gladushina, N. A.; Dragunova, A. V. (Odessa State Univ.). Astrometriya Astrofiz.; No. 26, 53-62(1975). (In Russian).

Peculiarities of infrared radiation were studied for K–M stars from the energy distribution in their spectra obtained at the Odessa Astronomical Observatory. Molecular bands in the spectra are identified, residual intensities in absorption bands of TiO λλ 7150, 7600, 8500 A are measured and their dependences on the spectral type are considered. The IR index is calculated which enables integral radiation to be compared in the visible and infrared regions, the m_5 index is determined which may serve as a reliable criterion of stellar classification from the temperature within the interval of K_2–M_4 spectral types. (15 refs, 7 figs, 2 tables) (auth)

17960 PHYSICS AND ASTRONOMY OF BLACK HOLES. "Not Seeing is Believing". Sciama, D. W. (Oxford Univ.). Q. J. R. Astron. Soc.; 16: No. 1, 1-12(Mar 1975).

An account is presented of the evolution of stars and the release of energy from nuclear transformations and from gravitational collapse. The mechanism of collapse which is believed to result in the formation of a black hole is described in the context

of the general theory of relativity and the critical (Schwarzschild) radius, and the possibility of actually detecting a black hole in the Galaxy is discussed. The recent detection of neutron stars in pulsars is referred to. The efficiency of black holes as sources of gravitational radiation is considered. The importance of black holes in the concepts of space and time is stressed. (UK)

17961 OUTBURST OF U CEPHEI. Batten, A. H. (Dominion Astrophysical Observatory, Victoria, B. C.); Fisher, W. A.; Baldwin, B. W.; Scarfe, C. D. Nature (London); 253: No. 5488, 174-176(17 Jan 1975).

The authors believe that the observations of the eclipsing binary U Cephei described have implications for the study of the evolution of binary systems and the understanding of novae. Details are given of the U Cephei system. The orbital period of approximately 2.5 has been increasing throughout the nearly 100 years that the star has been recognised as an eclipsing binary, the average rate of increase being about 5 parts per 10^9 per cycle, but there are irregular abrupt period changes superimposed on the average increase, and the present rate of increase is faster. The average rate can be explained as a result of transfer of matter from the G8 component star to the B7 star, and provides evidence for the existence of gas streams in the system. During the eclipse of September 7th, 1974, very strong emission was observed, and there were indications that the emission arose in a disk rotating around the primary star with an average velocity of about 250 km/sec. Hd emission was visible even in full light. The Hd emission was accompanied by a sharp absorption component that showed large variations. The disk around the primary star appears to have been expanding, and some matter probably left the system. Considerable changes in the spectrum of the primary star were observed during September. A new photosphere appears to have been created, possibly due either to exceptional ejection of matter from G8, or by expansion of the outer layers of B7. The latter view is favoured. It is thought that further study of the observations should improve understanding of the process of mass-transfer in systems of this kind. Relations to understanding of novae are briefly discussed. (UK)

17962 OUTBURST IN U CEPHEI. Plavec, M.; Polidan, R. S. (Univ. of California, Los Angeles). Nature (London); 253: No. 5488, 173-174(17 Jan 1975).

The studies described are part of a systematic survey of Hd line profiles in various types of stars, using a Varo image intensifier attached to the coude spectrograph of the 120 inch telescope and the 24 inch coude auxiliary telescope of the Lick Observatory. Hd emission is found to be commoner among the Algol-type eclipsing binaries than was thought. The observations were in agreement with models representing the Algol systems as evolved binaries in which mass is still being transferred from the late type secondary component to the hotter primary star. Although the general picture is fairly clear the problem remains as to how the flowing material and its angular momentum are distributed between the primary star, the disk revolving around it, and a possible envelope enclosing the whole system. The purpose of the studies was to obtain quantitative data on the processes occurring, and observations of U Cephei indicated that the mass transfer and disk formation may be a very variable process. Earlier attempts to detect emission in the system found either no emission or marginal emission, but in August 1974 very strong Hd emission was observed during a primary eclipse, details of which are given. The observations agreed with a model comprised of a rotating ring around the primary component. A quantitative analysis of the profiles is being made. The complete ring or disk must have been formed very recently and it is probable that the primary cause was an outburst of the secondary component, with an ensuing increase in the rate of mass transfer. (UK)

17963 STELLAR RING SR 58. Voroshilov, V. I.; Kolesnik, L. N.; Uranova, T. A. (Central Astronomical Observatory, Kiev). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 469-470(1975).

Translated from Astron. Zh.; 51: No. 4, 791-794(1974).

Photographic B, V magnitudes and spectral types are determined for 156 stars in the neighborhood of SR 58, and are used to prepare H-R diagrams for the ring and three comparison fields. The diagrams are entirely similar to one another and do not exhibit a well-defined main sequence. The dependence of the distance moduli of individual stars on their absolute magnitude (or spectrum) is also identical for SR 58 and the comparison fields. The existence of such a relationship demonstrates that the ring stars do not form an aggregation in space. The spectral-type composition (in particular, the percentage of O-B2 stars) is the same for the stars in SR 58 and in the comparison fields. The true mean distance modulus for the O-B2 stars in the ring does not differ significantly from the moduli for the field stars, according to Student's criterion, while the v^2 criterion indicates a statistically insignificant difference between the corresponding variances. Hence not even the early-type stars in SR 58 are associated in space. Furthermore, an irregularity in the distribution of absorbing material cannot explain the stellar-ring phenomenon. (auth)

17964 OSCILLATOR STRENGTHS FOR IONIZED IRON AND MANGANESE. de Boer, K. S. (Rijksuniversiteit, Groningen, Netherlands); Pottasch, S. R.; Morton, D. C.; York, D. G. pp 17-20 of Interstellar Absorption Lines in the Ultraviolet. de Boer, K. S. (ed.). Groningen; Rijksuniversiteit (20 Dec 1974).

The observed strengths of interstellar absorption lines of Fe II and Mn II in the spectra of α Vir, β Cen, τ Sco, and ζ Oph along with laboratory f values of some of these lines between 2343 and 2606 Å were used to determine curves of growth for these ions and the f values of 10 lines of Fe II and 3 lines of Mn II between 1055 and 1261 Å. The Fe and Mn abundances are derived. (auth)

17965 ESTIMATED PROBABILITIES OF FORBIDDEN $2s2p^1$ $^3P-2p^2$ ^1S, ^1D, ^3P TRANSITIONS FOR THE Be I, B II, C III SEQUENCE. Nikitin, A. A.; Feklistova, T. Kh. (Leningrad State Univ.). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 516-517(1975).

Translated from Astron. Zh.; 51: No. 4, 872-875(1974).

Probabilities of the forbidden $2s2p^1$ $^3p-2p^2$ ^1S, ^1D, ^3P transitions in the spectra of the isoelectronic sequence Be I, B II, C III, ..., are evaluated by a semiempirical method, with a view toward the study of emission lines in Wolf-Rayet and Of stars. A discussion is given of how these transitions influence the steady-state equations for the upper excited states of C III and N IV when interconfiguration effects are taken into account. (auth)

17966 MECHANISM FOR MASS LOSS BY A NOVA AFTER DETACHMENT OF THE ENVELOPE. Gorbatskii, V. G. (Leningrad State Univ.). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 446-450(1975).

Translated from Astron. Zh.; 51: No. 4, 753-760(1974).

Immediately after the main envelope is detached from a nova, material begins to flow out of the star. The expansion of gas heated during the outburst may be responsible for this outflow. Approximate equations are derived relating the mass-loss and outburst parameters. Estimates for the outburst energy and the mass of the heated gas are then obtained from observational data for several novae. (auth)

17967 SPECTROSCOPIC VARIABLE Ap STAR X SERPENTIS. Ryabchikova, T. A. Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 451-453(1975).

Translated from Astron. Zh.; 51: No. 4, 761-766(1974).

Variations in the equivalent width and radial velocity of several lines in the spectrum of the Ap star χ Ser are investigated on 25 spectrograms of 4-Å/mm dispersion. Concentrations of the elements Sr, Cr, Fe, Ti, Mg are found to occur in local regions or "spots" on the stellar surface, in agreement with the oblique-rotator hypothesis. (auth)

17968 CLASS OF MONOTONIC FUNCTIONS AS A SOLUTION OF ECLIPSING-BINARY LIGHT CURVES. Cherepashchuk, A. M.; Goncharskii, A. V.; Yagola, A. G. (Astronomical Inst., Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 460-463(1975).

Translated from Astron. Zh.; 51: No. 4, 776-781(1974).

An efficient algorithm is described for obtaining a solution to a Fredholm integral equation of the first kind as a class of bounded monotonic functions. This algorithm serves as the basis for a new method of solving the light curves of eclipsing binaries whose components have extended atmospheres. Fortran computer programs for the method have been published elsewhere. (auth)

17969 PHYSICAL PAIRS AMONG STARS WITH LARGE PROPER MOTIONS. Latyshev, I. N. (Leningrad State Univ.). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 466-468(1975).

Translated from Astron. Zh.; 51: No. 4, 786-790(1974).

The relative positions of stars with $\mu \geq 0''.23$ in the zone $-60 < \delta < +60°$ are investigated. Among the 10,000 stars considered, there are $\approx$ 350 physical pairs, whose components have an angular separation ranging from 1' to 1°. (auth)

17970 RAPID VARIATIONS OF BALMER LINE STRENGTHS IN THE SPECTRA OF Be STARS. McBeath, K. B. Chicago; Northwestern Univ. (1974). 95p. University Microfilms Order No. 75-7953.

Thesis (Ph. D.).

Low resolution photoelectric spectrophotometric measurements of the first four members of the Balmer series in the spectra of one Be and five Be (shell) stars were obtained with the 92-cm telescope and image dissecting scanner at Kitt Peak National Observatory in October, 1972. H alpha and H delta were observed simultaneously on two consecutive nights, while H beta and H gamma were also observed simultaneously one night before and one night after the H alpha and H delta measurements. Equivalent widths were computed for each observation and their standard

deviations from the mean values examined. Results indicate that in three of the program stars, at least one of the Balmer lines shows fluctuations in equivalent width sufficiently greater than those of the standards to be considered real. Power spectrum analysis of the data for the purpose of determining whether the fluctuations exhibit preiodicity yielded negative results, and attempts to detect variations in the observed line profiles were unsuccessful because of insufficient instrumental stability. The noncontinuous and nonperiodic nature of the variations along with their short time scale suggest some form of flare-like or shock origin for the phenomenon. (Diss. Abstr. Int., B)

17971 INVESTIGATION OF ECLIPSING BINARY STARS EXHIBITING CALCIUM II EMISSION. Oliver, J. P. Los Angeles; Univ. of California (1974). 329p. University Microfilms Order No. 75-9422.

Thesis (Ph. D.).

Three color photometry of some eclipsing binaries showing Calcium II emission is reported. A highly stable and accurate d.c. amplifier, and a new type digital averaging system are described. Past and current light curves of SS Boo, RS CVn, WY Cnc, WW Dra, UV Psc, Z Her, SS Cam, RW UMa, AR Lac, and RT Lac are discussed with particular emphasis on asymmetries in the heights of the maxima and variations in the depths of the minima. Both RS CVn and SS Boo show nearly sinusoidal variation outside eclipse. Spectra of SS Boo and RS CVn are discussed. The suggestion is made that many of these systems belong to a new category of variable eclipsing binary star. It is pointed out that most double line eclipsing binaries with late-type sub-giant secondary components fall into this group, and that many of the characteristics of this group are not easily explained on the basis of existing data and theory. Possible models are discussed and the need for future photometric and spectroscopic study is emphasized. (Diss. Abstr. Int., B)

17972 SPECTROPHOTOMETRY OF SUPERNOVAE AND THEIR REMNANTS. Kirshner, R. P. Pasadena, CA; California Inst. of Technology (1975). 149p. University Microfilms Order No. 75-9530.

Thesis (Ph. D.).

Spectrophotometry of extragalactic supernovae shortly after discovery, and of galactic supernova remnants has been used to derive the masses, temperatures, compositions, and distances of supernovae. The Crab Nebula is shown to have a mass of ionized hydrogen in excess of 0,3 M/sub mass/, but no enrichment of oxygen, nitrogen, or sulfur. The Cygnus Loop is shown to emit [Fe XIV], indicating gas at 2×10^6 ^{0}K: this establishes the thermal nature of the x-ray emission, and casts doubt on the Loop's size and distance. Type II supernovae are shown to be consistent with a few solar masses of material at cosmic abundance. Their distances are found without reference to any other astronomical distance through a model of the expansion. Type I supernovae are shown to consist of about 1 solar mass of matter that may be 20 times enriched in iron, if the identification of [Fe II] lines at late stages is correct. (Diss. Abstr. Int., B)

17973 GAS FLOW IN CATACLYSMIC VARIABLE STARS. Flannery, B. P. Santa Cruz, CA; Univ. of California (1974). 93p. University Microfilms Order No. 75-8474.

Thesis (Ph. D.).

A hydrodynamic scheme for numerically simulating gas flow in binary stars is presented. The method includes both gravitational and pressure forces, and allows for shock formation and radiative cooling. Mass transfer originating from thermal evaporation through the inner Lagrangian point is studied in a binary system scaled to resemble the dwarf nova Z Cam. The gas flow is followed for a total time of 1,25 binary orbital periods. The dissipative effect of radiative cooling in shocks results in the rapid formation of a ring in direct rotation around the component receiving mass. Also, an optically thick, relatively confined shock front forms at the intersection of the ring and the stream from the Lagrangian point. The shock's temperature, 23,000^{0}K at maximum, and location confirm the major elements of the "hot spot" model proposed to account for observations of cataclysmic variable stars. (Diss. Abstr. Int., B)

17974 BINARY STARS: A LOOK AT SOME INTERESTING DEVELOPMENTS. Wilson, R. E. Mercury; 3: 4-12(1974).

The study of binary stars begins with the same problems and principles which are encountered for single stars but presents many new ones as well. Some of the main areas of research on these objects include the following: Decoding the information in the observational record. None of the close binaries can be separated visually, even in a large telescope. For such systems changes in the brightness and the radial velocity are analyzed to determine the characteristics of the two component stars. Developing a theory of the direct physical interaction of binary stars. Stars which are very close to each other are expected to interact, both by tides and by radiation. Many are found to be exchanging material between components, and all do so eventually. Predicting the evolution of such systems. The proximity of the other star will alter the life cycle through which each star goes. The results of observation are compared with predictions based on theory of binaries and on single-star evolution theory to discover the various stages which occur. (IAA)

17975 YAVLENIYA NESTATSIONARNOSTI I ZVEZDNAYA EVOLYUTSIYA. (Variable Stars and Methods for Studying Them. Phenomenon of Variability and Stellars Evolution). Boyarchuka, A. A.; Efremova, Yu. N. (eds.). Moscow; Izdatel'stov Nauka Glavnya Redaktsiya Fiziko-Matematicheskoi Literarury (1974). 375p.

Eight articles on stellar variability and evolution are compiled. The articles discuss variable stars of young clusters and of the galactic disc, Wolf–Rayet stars, stars of spectral class B with emission lines, variable stars of the galactic halo and of stellar aggregates formed long ago, characteristics and evolution of close binary systems, x-ray sources in binary systems, supernovae, and variable objects of a nonstellar nature. An extensive bibliography covering the literature up to 1973 is appended to each article. (JSR) (116 figures, 52 tables)

17976 DDO INTERMEDIATE-BAND PHOTOMETRY OF MOVING-GROUP STARS. Boyle, R. J.; McClure, R. D. (Yale Univ., New Haven, CT). Publ. Astron. Soc. Pac.; 87: No. 515, 17-36(Feb 1975).

G and K giant stars in several of Eggen's moving groups have been observed on the DDO system. The cyanogen strength and absolute magnitude calibrations of the system are used to discuss the assignments of the observed stars to moving groups. We are able to confirm the assignment of some 50 percent of the members of the Hyades moving group and thus to segregate out a more homogeneous sample of Hyades group stars. These stars can be used to recalibrate intrinsic Hyades giant sequences. Less firm conclusions are reached concerning the other, older, groups discussed. (5 tables, 13 figures, 35 references) (auth)

17977 STRUCTURE AND AGE OF THE LOCAL ASSOCIATION (PLEIADES GROUP). Eggen, O. J. (Australian National Univ., Canberra). Publ. Astron. Soc. Pac.; 87: No. 515, 37-63(Feb 1975).

The available photometric and motion parameters for some 500 early-type stars brighter than M/sub V/ equals -1/sup m/ are used to compute space-motion vectors. It is concluded that (a) about one-third of the stars are members of the local association (Pleiades group) which are easily isolated from the other interarm stars because V equals -25 km sec^{-1}; (b) some 50 stars with aberrant velocity vectors, and often referred to as "runaway stars", may actually be members of the old-disk, or even the halo, population; (c) perhaps the local association (or Gould Belt) stars cannot be separated from other interarm objects on the basis of positional criteria alone; and (d) the age spread in the local association ranges from that of the cluster NGC 2287 to pre-main-sequence stars in several star-producing regions within the association including the large Taurus Aurigae dark cloud and isolated small clouds, such as that near HR 5999/6000. (19 figures, 11 tables, 47 references) (auth)

17978 INTERSTELLAR REDDENING IN FRONT OF GLOBULAR CLUSTERS. Crawford, D. L.; Barnes, J. V. (Kitt Peak Observatory, Tucson, AZ). Publ. Astron. Soc. Pac.; 87: No. 515, 65-76(Feb 1975).

187 field stars in galactic fields containing globular clusters have been observed. For 15 of the 28 fields, color excesses that should be essentially the same as for the globular clusters are derived. Three additional cases deserve further work. The remaining ten fields are at low galactic latitude. To get good reddening estimates by this technique for these objects will require a selection of stars in the immediate spatial vicinity of the cluster. (7 figures, 2 tables, 13 references) (auth)

17979 COLOR-MAGNITUDE DIAGRAM FOR THE STRONG-LINE GLOBULAR CLUSTER NGC 6553. Hartwick, F.D.A. (Univ. of Victoria, Canada). Publ. Astron. Soc. Pac.; 87: No. 515, 77-81(Feb 1975).

A preliminary color-magnitude (CM) diagram is obtained for NGC 6553, one of the most strong-lined globular clusters known. The diagram shows features characteristic of other metal-rich globular clusters. The position in the CM diagram of an RR Lyrae star spatially super-imposed on the cluster suggests that it is a member. A tentative distance modulus for NGC 6553 of $(m-M)_0$ equals 13/sup m/4 +- 0.3 is derived. (2 figures, 3 tables, 16 references) (auth)

17980 CoD-44^{0}3318: A PECULIAR LUMINOUS F STAR. Irvine, N. J. (Univ. of Michigan, Ann Arbor). Publ. Astron. Soc. Pac.; 87: No. 515, 87-88(Feb 1975).

The unnamed variable CoD – 44°3318 has been classified F0 Ipe. It is probably one of a rare group of luminous objects related to the T Tauri stars. (13 references, 2 tables) (auth)

17981 LUMINOUS STARS IN GALACTIC SUPERNOVA REMNANTS. Johnson, H. M. (Lockheed Missiles and Space Co., Palo Alto, CA). Publ. Astron. Soc. Pac.; 87: No. 515, 89-95(Feb 1975).

A discussion of reasons to expect luminous stars in the vicinity of supernova remnants is followed by a list of them from the Luminous Stars in the Northern- and Southern-Milky Way catalogs inside the areas of 24 SNR in An Optical Atlas of Galactic Supernova Remnants and in distances that are consistent with the SNR distances. This is supplemented by remarks on stars and other data of seven more optical counterparts of possible SNR that are not in the Atlas, including new spectroscopic data of S 104 and S 188. (31 references, 3 tables) (auth)

17982 PRE-MAIN-SEQUENCE MASSES AND EVOLUTION IN NGC-2264. McNamara, B. J. (Univ. of California, Santa Cruz). Publ. Astron. Soc. Pac.; 87: No. 515, 97-101(Feb 1975).

The masses of nine pre-main-sequence stars in NGC 2264 have been determined by employing flux measurements extending from 0.36 mu–3.4 mu in conjunction with model atmospheres. The resultant masses are in good agreement with theoretical predictions although there appears to be a systematic trend in that those stars located near the main sequence are more massive than expected from evolutionary calculations of nonrotating stars. In addition, a probable age spread of at least 2×10^6 years is shown to exist in NGC 2264. (10 references, 2 tables, 1 figure) (auth)

17983 PHOTOMETRY OF POSSIBLE BARIUM STARS. Eggen, O. J. (Australian National Univ., Canberra). Publ. Astron. Soc. Pac.; 87: No. 515, 111-113(Feb 1975).

UBVRI photometry of 42 newly announced Ba stars is discussed. Most of these objects may not be Ba stars in the usual sense of that classification. (1 figure, 2 tables, 5 references) (auth)

17984 EMISSION-LINE EFFECTS IN H alpha, H beta, H gamma, AND UVBY PHOTOMETRY FOR B-TYPE STARS. Crawford, D. L. (Kitt Peak National Observatory, Tucson, AZ); Barnes, J. V.; Perry, C. L. Publ. Astron. Soc. Pac.; 87: No. 515, 115-121(Feb 1975).

H alpha, H beta, H gamma, and four-color data for 780 B-type stars have been compiled and the relation between indices with respect to possible effects due to emission in the hydrogen lines has been analyzed. It is possible to separate supergiants from Be-type stars by means of an H alpha vs H beta diagram. (5 figures, 1 table, 19 references) (auth)

17985 UBVr SEQUENCES FOR TWO ETA CARINAE-LIKE OBJECTS. Craine, E. R.; Tapia, S. (Univ. of Arizona, Tucson). Publ. Astron. Soc. Pac.; 87: No. 515, 131-135(Feb 1975).

Comparison sequences are presented for MWC645 and IRC 10420 in order to stimulate investigations of the light curves of these objects. Both are reported to be similar to eta Car and hence may exhibit significant changes in brightness. Previously unpublished finding charts appear for each object. (2 figures, 2 tables, 7 references) (auth)

17986 HELIUM EMISSION IN THE SPECTRUM OF kappa CANIS MAJORIS. Bahng, J.D.R.; Hendry, E. (Northwestern Univ., Chicago). Publ. Astron. Soc. Pac.; 87: No. 515, 137-139 (Feb 1975).

Coude spectra of kappa CMa in the red region show H alpha and He I lambda lambda 5876, 6678 in emission. Each of the lines has two emission components but the helium lines have no detectable absorption feature in between. While the H alpha emission peaks are separated by 160 km sec^{-1}, the helium lines are separated by 400 km sec^{-1}. A simple model is proposed to account for the behavior of these emission lines. (1 figure, 8 references) (auth)

17987 FURTHER OPTICAL OBSERVATIONS OF HZ HERCULIS. Bahcall, J. N. (Inst. for Advanced Study, Princeton, NJ); Bahcall, N. A.; Herczeg, T. J. Publ. Astron. Soc. Pac.; 87: No. 515, 141-145(Feb 1975).

Optical observations of HZ Her made in the spring and summer of 1973 are presented. Some of the observations are practically coincident with estimated turn-on times for Her X-1 and others are simultaneous with X-ray observations made using the Copernicus satellite. Eight magnitudes were also measured from old plates for the epoch 1953-60; these measurements confirm the long-term variations for that epoch reported by Jones, Forman, and Liller (1973). An interesting theoretical explanation by Fabian, Pringle, and Rees (1973) for the persistence of large optical variations throughout the 35-day X-ray period is ruled out by simultaneous UHURU (X-ray) and Wise Observatory (optical) observations. (1 figure, 1 table, 26 references) (auth)

17988 OBSERVATIONS OF THE C III lambda 8500 ($3s^1S$–$3p^1P$) LINE IN O AND Of STARS. Mihalas, D. (High Altitude Observatory, Boulder, CO); Frost, S. A.; Lockwood, G. W. Publ. Astron. Soc. Pac.; 87: No. 515, 153-161(Feb 1975).

Measurements from coude infrared image-tube spectra of the equivalent widths of the C III lambda 8500 ($3s^1S$–$3p^1P^0$), He II lambda 10124 (n equals 4-n equals 5), and hydrogen P delta lines have been made for several O and Of stars, and are presented here. An attempt to measure the C III lambda lambda 9701-15 complex ($3p^3P^0$–$3d^3D$) was thwarted by interference from telluric H_2O absorption. The C III lambda 8500 line strengths provide useful constraints on possible theoretical models, and suggest, on the basis of the calculations of Nussbaumer (1971), that the C III lambda 5696 ($3p^2P^0$–$3d^1D$) and lambda 8500 lines are formed in relatively extended atmospheres, with a dilution factor approximately 0.1. (2 figures, 2 tables, 20 references) (auth)

17989 OBSERVATIONS OF THE RED-DWARF EMISSION-LINE OBJECTS LP101-15, BY DRACONIS, GT PEGASI, AND FF ANDROMEDAE. Martins, D. H. (Univ. of Florida, Gainesville). Publ. Astron. Soc. Pac.; 87: No. 515, 163-171(Feb 1975).

Photoelectric UBVRI photometry of LP101-15, BY Dra, GT Peg, and FF And is presented, and implications with respect to the "center of activity" model are discussed. Apparently this is the most physically acceptable model to data. Facular-like areas and flare activity are included in an attempt to explain all aspects of the behavior of this class of stars. Data for BY Dra and GT Peg are inconclusive at this time, but FF And can be fairly well understood in terms of the "center of activity" model. A slight secondary eclipse may have been detected for LP101-15, but verification is needed. (4 figures, 2 tables, 17 references) (auth)

17990 SPECTRAL TYPES IN TRUMPLER 10. Levato, H.; Malaroda, S. (Observatorio Astronomica, La Plata). Publ. Astron. Soc. Pac.; 87: No. 515, 173-175(Feb 1975).

MK types for 25 stars in the field of Trumpler 10 are given. The true distance modulus of Trumpler 10 is found to be 8/sup m/ 2, corresponding to a distance of 440 pc. (2 tables, 1 figure, 5 references) (auth)

17991 SHORT TIME-SCALE PHOTOMETRIC VARIABILITY OF THE SHELL STAR EW LACERTAE. Lester, D. F. (Univ. of Oregon, Eugene). Publ. Astron. Soc. Pac.; 87: No. 515, 177-184 (Feb 1975).

The quasi-periodic variability of the shell star EW Lac is considered. Four-color photometry is presented which defines the time scale (approximately 0.7d) and the wavelength dependence of the variations. The observed variations are compared with those expected from several possible models for variability. The wavelength dependence of the variability is suggestive of temperature changes in an early-type atmosphere, and seems to exclude possible interpretation in terms of changing absorption, emission, or scattering in the shell. (3 figures, 1 table, 22 references) (auth)

17992 NEW COOL AND EMISSION-LINE OBJECTS. Krumenaker, L. E. (Case Western Reserve Univ., Cleveland). Publ. Astron. Soc. Pac.; 87: No. 515, 185-187(Feb 1975).

A number of new carbon, S-type, and H alpha-emission stars have been recently discovered on plates taken with the Burrell Schmidt telescope. Finding charts are given. (2 figures, 2 tables, 4 references) (auth)

17993 N-TYPE CARBON STARS AND THE 3-alpha PROCESS. Kilston, S. (Univ. of California, Los Angeles). Publ. Astron. Soc. Pac.; 87: No. 515, 189-206(Feb 1975).

High-dispersion yellow-red spectra of eight representative N-type carbon stars have been matched by Minneart model synthesis. CN, C_2, and Fe line strengths imply high abundances of free carbon, C–O, such that N-star surface carbon must originate from 3-alpha He-shell burning, rather than from CNO equilibrium processes. CN/C_2 ratios ranging from 4 to 200 imply values of log(C–O)/H from –2.7 to –4.5; these lead to C/O ratios from 2.9 to 1.033, if the oxygen abundances are solar. Nitrogen abundances for these stars are also essentially solar, with a mean value log (N/H) equals -4.10 ± 0.18, also ruling out substantial contributions from CNO processing. Values of the $^{12}C/^{13}C$ ratio range from 3.5 to greater than 25. Zr/Ti ratios are a factor of 2 to 10 greater than solar, similar to the S stars. Ba is enriched only in some high Zr stars. Rare-earth abundances are subject to severe error. Lithium abundances range from the meteoritic to below solar. The range of log g is –0.3 to 1.7. Excitation temperatures, both atomic and molecular, are between 2500°K and 3150°K. Microturbulent velocities are in most cases near 6 km sec^{-1}. Relations to other red-giant stars are considered. (auth)

17994 THE EFFECTIVE TEMPERATURES OF EARLY-TYPE STARS DERIVED FROM TD 1 SATELLITE ULTRAVIOLET PHOTOMETRY. Nandy, K. (Royal Observatory, Blackford Hill,

Edinburgh); Schmidt, E.G. Astrophys. J. 198: No. 1, 119-125 (15 May 1975).

A grid of model atmospheres has been calculated, and the resulting energy distributions have been compared with measured energy distributions of 14 stars of spectral types between B0 and A2. Both supergiants and main-sequence stars are represented on the list. The energy distributions are from a combination of TD 1 satellite data and ground-based photometry, and extend from 1300 Å to 5500 Å. A temperature scale is derived for the main-sequence stars and for the supergiants, and this is compared with values obtained for five of the stars for which angular diameters have been measured. For the star ϵ Ori, we were able to derive the luminosity from our data and the angular diameter, assuming it to be a member of the Orion association. This luminosity implies that the mass of this BO Ia star is 20–25 $M_\odot$. (auth)

17995 THE ANGULAR DIAMETER OF MU GEMINORUM. Nelson, M.R. (Department of Astronomy and Department of Physics, University of Illinois, Urbana). Astrophys. J. 198: No. 1, 127-129 (15 May 1975).

The angular diameter of μ Geminorum (Sp M3 III) has been measured by lunar occultation yielding a value of 15.6 milli-arcseconds for a uniformly illuminated disk or 16.5 for a fully darkened disk. (auth)

17996 CLASSIFICATION OF INTRINSIC VARIABLES. VI. ULTRASHORT-PERIOD, VERY SMALL AMPLITUDE B—TYPE VARIABLES. Eggen, O.J. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, The Australian National University). Astrophys. J. 198: No. 1, 131-138 (15 May 1975).

These very young disk-population variables are found to be distributed in a very narrow instability strip, extending from $M_{bol} = -9$ mag to -3 mag and including stars with a range of at least 25 to 5 solar masses. Some new variables, for which periods are not yet available, are suggested as possibly filling the existing gaps in the luminosity distribution and extending the instability region to still lower masses. (auth)

17997 ON THE THEORETICAL DETERMINATION OF GAP PARAMETERS FOR CLUSTER COLOR-MAGNITUDE DIAGRAMS AND THEIR COMPARISON WITH OBSERVATIONAL DATA. Mitalas, R. (Department of Astronomy, University of Western Ontario). Astrophys. J. 198: No. 1, 139-144 (15 May 1975).

A new procedure to determine the theoretical gap parameters of clusters has been developed. The method takes into account the existence of a range of masses in the hydrogen exhaustion phase. It is demonstrated that the mass range of stars in the hydrogen exhaustion phase must be taken into account before theory and observation can be compared. (auth)

17998 GAMMA-RAY LINES: A ^{22}Na RADIOACTIVE DIAGNOSTIC OF YOUNG SUPERNOVAE. Clayton, D.D. (Department of Space Physics and Astronomy, Rice University). Astrophys. J. 198: No. 1, 151-152 (15 May 1975).

The nuclear γ-ray lines emitted following the decay of ^{22}Na should be detectable for roughly a decade following Galactic explosions of massive stars in which the helium shell is heated sufficiently to synthesize ^{19}F and ^{21}Ne from seed ^{14}N. (auth)

17999 MEAN LIFE OF THE $5p\,^2P_{3/2}$ RESONANCE LEVEL IN Ag I. Klose, J.Z. (National Bureau of Standards). Astrophys. J. 198: No. 1, 229-233 (15 May 1975).

The mean life of the $5p\,^2P_{3/2}$ resonance level in Ag I has been measured at two different vapor densities using electronic excitation and a method of delayed coincidence. The lifetime values, obtained by optically detecting the decay of the $5p\,^2P_{3/2} \rightarrow 5s\,^2S_{1/2}$ (3280.68 Å) resonance transition, increase with increasing vapor density. This vapor density dependence was interpreted as being due to the imprisonment of the 3281 Å resonance radiation. The Holstein theory of the imprisonment of resonance radiation was applied to the lifetime-versus-vapor density data to yield the following results: $\tau_0 = 6.5 \pm 0.6$ ns, $A_{3281} = 1.53 \pm 0.14 \times 10^8\ s^{-1}$, and $f_{3281} = 0.50 \pm 0.5$. The error limits were derived primarily from estimated uncertainties in the measured mean lives and possible variations in the vapor densities during the runs. Experimental results of other workers are presented for comparison with the results of the present work. (auth)

18000 A SYSTEM OF STANDARD STARS FOR ROTATIONAL VELOCITY DETERMINATIONS. Slettebak, A.; Collins, G.W. II (Perkins Observatory, Ohio State and Ohio Wesleyan Universities); Boyce, P. B.; White, N. M.; Parkinson, T. D. Astrophys. J. Suppl. Ser. 29: No. 281, 137-159 (May 1975).

Profiles for the He I λ 4471, Mg II λ 4481, and Fe I λ 4476 lines were measured in the spectra of 217 bright northern and southern stars of types O9—F9, using photoelectric scans and photographic coudé spectrograms obtained at the Cerro Tololo Inter-American Observatory, Kitt Peak National Observatory, and Lowell Observatory. Half-intensity widths of the observed line profiles were compared with the corresponding quantities in a set of theoretical rotationally-broadened line profiles computed using the model-atmosphere approach. The resulting v sin i's are used to establish a system of standard rotational velocity stars, for use in estimating v sin i directly from visual inspection of spectrograms. An atlas of rotationally broadened spectra is presented, showing the effects of rotation on spectra of representative B-, A-, and F-type stars. (auth)

18001 CYANOGEN STRENGTHS, LUMINOSITIES, AND KINEMATICS OF *K* GIANT STARS. Janes, K.A. (Yale University Observatory). Astrophys. J. Suppl. Ser. 29: No. 282, 161-183 (May 1975).

DDO intermediate-band photometry of 1200 G and K stars is used to derive procedures to estimate the anomalous cyanogen strength and the absolute visual magnitude of a G or K giant star. As expected, the CN-strength index, δCN, is correlated with [Fe/H], but the development of the absolute magnitude calibration leads to several interesting results: (i) A revision is necessary in the Wilson-Bappu calibration of K-line absolute magnitudes, M_v(K). (ii) No correlation is found between δCn and M_v(K), which implies that there is no metallicity-dependence in M_v(K). (iii) The new calibration yields a Hyades distance modulus $(m-M) = 3.22$ mag. The DDO absolute magnitudes, plus published radial velocities and proper motions, are used to calculate space velocities for 799 giants. The Z velocities (perpendicular to the galactic plane) show the expected correlation with δCN, and the extreme CN-weak stars have high velocities in the plane. In addition, the kinematics suggest that there is an actual galactic gradient in the mean value of δCN among K giants. This gradient is probably the result of a radial gradient in the nitrogen abundance in the galactic plane. (auth)

18002 G2.4+1.4, A SUPERNOVA REMNANT OR RING NEBULA AROUND A PECULIAR STAR. Johnson, H.M. (Lockheed Missiles and Space Company). Astrophys. J. 198: No. 1, 111-118 (15 May 1975).

G2.4+1.4 is a probable nonthermal radio source and an optical nebula which appears to be a supernova remnant (SNR). It also contains an O VI sequence star of great excitation. We present new radiofrequency continuum and (nil) H 92α observations, optical spectroscopy, and Fabry-Perot scanner observations of the nebula. The object distance (5 kpc?), origin of gas kinematics (SNR expansion?), and mode of excitation of the gas (photoexcitation and/or shock wave?) remain uncertain. We discuss the possible roles of the O VI star as "runaway" in a SNR, as a source of photoexcitation, and as an ejector of a "counterfeit" SNR. (auth)

18003 SILICON-RICH STELLAR ENVELOPE. Gurzadyan, G. A.; Rustambekova, S. S. (Garny Space Astronomy Lab., Erevan). Nature (London); 254: No. 5498, 311-312(27 Mar 1975).

It is stated that during analysis of Orion 2 data derived from a space astrophysical experiment, a hot star with a gaseous envelope, SAO 077308, was indicated. This star showed a very strong emission line at 2520 Å in its UV spectrum, and identification of this line with the resonance sextet of neutral Si seems probable. An examination of the abnormal abundance of Si in the envelope of the star was made. To what degree the discovered abnormal abundance of Si is characteristic not only of the gaseous envelope of the star but also of the photosphere itself is difficult to specify without additional data. (UK)

18004 POSSIBLE POWER SOURCE OF SEYFERT GALAXIES AND QSOs. Hills, J. G. (Univ. of Michigan, Ann Arbor). Nature (London); 254: No. 5498, 295-298(27 Mar 1975).

The possible presence of massive black holes in the nuclei of galaxies has been suggested many times. In addition, there is considerable observational evidence for high stellar densities in these nuclei. It is shown that the tidal breakup of stars passing within the Roche limit of a black hole initiates a chain of events that may explain many of the observed principal characteristics of QSOs and the nuclei of Seyfert galaxies. (auth)

18005 INDIRECT METHODS FOR DETECTING γ-RAYS BURSTS FROM SUPERNOVAE. Belyaev, A. A.; Guzhavin, V. V.; Ivanenko, I. P. (Moscow State Univ.). Nature (London); 254: No. 5499, 461-462(3 Apr 1975).

Comments are made on the paper by Porter who suggests the possibility of detecting γ quanta from supernova bursts with a detector located at sea level, based on the results of a Monte Carlo computation procedure for electromagnetic showers. The analysis presented casts doubt on the possibility of detecting the bursts from supernovae with a sea-level or mountain detector. (UK)

18006 BY Dra-TYPE STARS. II. Further Photoelectric Observations and Their Analysis. Chugainov, P. F. Izv. Krym. Astrofiz. Observ.; 52: 3-31(1974). (In Russian).

The photoelectric study of the light variability and the flare activity of red dwarf stars has been carried out. Four of the stars

studied, FF And, Gliese 517, BY Dra and GT Peg, are known variables of BY Dra-type. Two new variables of BY Dra-type, YZ CMi and BD− 10°4662, have been discovered. The conclusion on inconstancy of the amplitude and the mean brightness of BY Dra-type stars is confirmed. The changes of photometric periods are found for Gliese 517 and YZ CMi and confirmed for BY Dra. Evidences are obtained that flare activity of BY Dra-type stars may be almost constant, independently of the periodical brightness variation of the star. These results are considered on the basis of the hypothesis in which the light variability of BY Dra-type stars is due to the axial rotation and the presence of a spot on the star surface. On one hand, the independence of the flare activity on the periodical light variability points to the absence of an interrelation between the location of the active regions and the brightness distribution on the star surface. On the other hand, the changes in photometric periods probably evidence such displacements of a spot which changes the angular velocity of its axial rotation. The same explanation of the variability of the photometric period was firstly proposed by Albrecht and others for the Sun. Therefore, it can be supposed that the periodical light variations of BY Dra-type stars and the sun are similar. (11 figs, 3 tables, 31 refs) (auth)

18007 THREE COLOR PHOTOELECTRIC PHOTOMETRY OF 15 Vul AND γ Cyg. Metik, L. P. Izv. Krym. Astrofiz. Observ.; 52: 32-34(1974). (In Russian).

15 Vul and γ Cyg were observed photoelectrically from July 3 to September 9, 1971 with the 20 cm reflector of the Crimean astrophysical observatory in a photometric system close to UBV. Two comparison stars have been used for each of the investigated stars. The accuracy (mean square error of one observation) was found to be equal to ± 0.014m. The light curves of 15 Vul and γ Cyg are similar in three rays. Amplitudes of Yellow, Blue and Violet light curves equal 0.02−0.03m for 15 Vul and 0.03−0.04m for γ Cyg. It is suspected that the brightness variations for 15 Vul and γ Cyg have periods equal to approximately 4 to 6 days, if the light variations are real. (2 figs, 2 tables, 5 refs) (auth)

18008 SPECTROPHOTOMETRIC STUDY OF THE ECLIPSING-VARIABLE SYSTEM RR Lyn. Rachkovskaya, T. M. Izv. Krym. Astrofiz. Observ.; 52: 35-48(1974). (In Russian).

The spectrum of the eclipsing variable system RR Lyn has been studied within the intervals λλ3600−4900 Å and λλ5400−6600 Å using dispersions of 15 and 36 Å/mm. Within the wave length range λλ3600−4900 Å, only the spectrum of the primary component was observed; but within the interval λλ5400−6600 Å, lines of the secondary component D_1 and D_2 of sodium and H_α are present. The spectral type of the primary component was determined. There is a difference between the metallic, hydrogen, and calcium spectral types. The axial velocity of the primary component of RR Lyn $v \sin i$ is ≤ 22 km/sec. The atmosphere of this component was analyzed by the curve of growth method. The turbulence velocity equals $v_t = 4.7$ km/sec, and the excitation temperature $\theta_e = 0.65$. There is a deficiency of calcium and scandium and an enhancement of elements heavier than strontium. (4 tables, 3 figs, 11 refs) (auth)

18009 EVALUATION OF THE HELIUM ABUNDANCE IN ATMOSPHERES OF HOT STARS. Lyubimkov, L. S. Izv. Krym. Astrofiz. Observ.; 52: 49-64(1974). (In Russian).

In the determination of the helium abundance, N(He)/N(H), in atmospheres of hot stars, the most accurate results are obtained by model atmosphere analysis, but this procedure is time-consuming. Therefore, it is interesting to consider more simple approximate methods of determining this value. A similar method was proposed by A. Unsöld, but as it is shown, this method does not agree with modern calculations of model atmospheres and can give N(He)/N(H) values which are 3 to 4 times higher or lower than those obtained by model atmosphere analysis. A simple, more accurate method of the evaluation of the helium abundance in atmospheres of early-type stars is proposed. It is based on comparison of the observed ratio of λ4471 He I and H_γ equivalent widths and the theoretical one computed for N(He)/N(H) = 0.10 from model atmospheres. Using this method it is possible to calculate the helium abundance in two ways: (1) from known values of the effective temperature T_{eff} and the acceleration of gravity g; (2) from the spectral type of the star. In both cases, the results are in good agreement with N(He)/N(H) values obtained by model atmosphere analysis. It is shown that the proposed method gives the best accuracy for B1−O7 stars. In conclusion, the helium abundance in atmospheres of about 150 O- and early B-stars is evaluated. (7 tables, 6 figs, 41 refs) (auth)

18010 SOURCE FUNCTION CALCULATION IN STELLAR ATMOSPHERES. Lyubimkov, L. S. Izv. Krym. Astrofiz. Observ.; 52: 148-157(1974). (In Russian).

The substantial defect of the iterative method used for source function calculations in stellar atmospheres is bad convergence. To speed up the convergence of the iterative process, a variational principle used by T. A. Germogenova and T. A. Sushkevitch for the numerical solution of the equation of transfer is proposed. By means of a method constructed in this way, the source function in the core of the line λ 4808,16 Fe I in solar atmosphere is calculated. Only three approximations were needed to obtain this value with 4 to 5 accurate figures. (1 table, 10 refs) (auth)

18011 UNIFORM-DENSITY COLD NEUTRON STARS IN GENERAL RELATIVITY. Krori, K. D.; Borgohain, P. (Cotton Coll., Gauhati, India). J. Phys., A (London); 8: No. 4, 512-520 (Apr 1975).

Nauenberg's uniform-density approximation method has been applied to study the stability of uniform-density neutron stars obeying (a) an equation of state due to Cohen, Langer, Rosen and Cameron, (b) an equation of state due to Bethe and Johnson and (c) extreme relativistic equations of state. It has been found that neutron stars may be stable in the first two cases but are unstable in the third case. (auth)

18012 ASYMPTOTIC GIANT BRANCH IN NGC 6397. Mallia, E. A. (Oxford Univ.). Mon. Not. R. Astron. Soc.; 170: No. 3, 57P-60P(Mar 1975).

Photoelectric UBV photometry of stars in the globular cluster NGC 6397 has recently been published by Cannon. He found a red giant branch with a very small scatter in (B-V). Two stars (Nos. 28 and 75) were described as the only possibly "bona-fide asymptotic branch stars." Cannon's criteria for cluster membership were position on the two-colour diagram and (unpublished) proper motions, neither of which necessarily furnishes decisive evidence. The low cluster radial velocity (+11 km s^{-1}) presents another difficulty. An examination of the spectra of individual stars would provide further information, although there is still a possibility of finding a low velocity Population II star in the same direction as the cluster. In spite of these difficulties, Zinn's results on giant stars in M 92 were sufficiently interesting to make an attempt to obtain spectra of stars of similar type in NGC 6397 worthwhile. Spectra (λλ4150 to 4700) of the asymptotic giant branch stars and of neighboring red giants were obtained with the Carnegie image tube spectrograph of the 1.88-m Radcliffe reflector at SAAO Pretoria, at a nominal dispersion of 22.5 Å mm^{-1}. The results are presented and discussed. (auth)

18013 PERIOD CHANGES IN ERUPTIVE BINARIES. Pringle, J. E. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 633-642(Mar 1975).

The evidence for period changes in close eclipsing binary systems is investigated from a statistical viewpoint. It is found that the evidence is not clear cut as has been previously suggested. (auth)

18014 ISOTOPIC ABUNDANCE RATIOS FOR CARBON AND NITROGEN IN NOVA HERCULIS 1934. Sneden, C.; Lambert, D. L. (Indiana Univ., Bloomington). Mon. Not. R. Astron. Soc.; 170: No. 3, 533-540(Mar 1975).

Spectra of Nova Herculis 1934 taken during the episode of intense CN absorption have been analyzed to obtain limits on the isotopic abundance ratios $^{12}C/^{13}C$ and $^{14}N/^{15}N$. The results, $^{12}C/^{13}C \geq 1.5$, $^{14}N/^{15}N \geq 2$, are compared with recent predictions based on models of thermonuclear runaways in hydrogen-rich envelopes of white dwarfs. (auth)

18015 AMPLIFICATION OF RADIATION BY RELATIVISTIC PARTICLES IN A STRONG MAGNETIC FIELD. Blandford, R. D. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 551-557(Mar 1975).

The possibility of maser action by relativistic charged particles confined to one-dimensional motion in a strong magnetic field is considered. It is shown that if the field lines are curved to form circular arcs, genuine maser action is impossible. Under more complex electrodynamical conditions when, for instance, points of inflection and torsion may be present in the field geometry or particle creation, electrostatic acceleration or plasma effects may be occurring, maser action is not impossible. Simple estimates suggest that this type of mechanism cannot be excluded from being responsible for the coherent radio emission from pulsars. (auth)

18016 IMPORTANCE OF BOUND-FREE OPACITY OF OH AND CH IN SOLAR AND STELLAR ATMOSPHERES. Tarafdar, S. P.; Das, P. K. (Tata Inst. of Fundamental Research, Bombay). Mon. Not. R. Astron. Soc.; 170: No. 3, 559-568(Mar 1975).

Absorption cross-sections for bound-free transitions of OH and CH have been estimated and their importance in the atmosphere of the sun and of other stars has been examined. It has been found that OH bound-free opacity is most important just beyond the edge of Mg I at 2514 Å, where the need of some unknown source of opacity is most significant in the solar atmosphere. The impor-

tance of this source of opacity increases with decreasing effective temperature. However, the spectral type where it starts becoming important and the magnitude of its contribution depend on the value of the oscillator strength of the transition and on the form of the repulsive potential which are poorly known. The bound-free opacity of CH has been found to be not insignificant in carbon stars; the amount of its contribution depends on the relative abundance of carbon and on inadequately known values of oscillator strengths of different transitions and forms of the potential curves of the upper states. (auth)

18017 EMISSION-LINE STARS WITH INFRARED DUST EMISSION. Implications of the Galactic Distribution. Allen, D. A.; Glass, I. S. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 579-587(Mar 1975).

Near-infrared photometry of a final selection of emission-line stars is presented. A sample of about 700 such stars is analyzed and it is shown that those with circumstellar dust have a spiral arm distribution in the galaxy. The peculiar Be stars with dust are also considered in isolation; these too are found to have a Population I distribution. It is therefore unlikely that they are symbiotic stars or the progenitors of normal planetary nebulae; they probably form a distinct type whose nearest relatives are the VV Cephei stars. (auth)

18018 ANGULAR MOMENTUM TRANSFER IN BINARY SYSTEMS. Wilson, R. E.; Stothers, R. (National Aeronautics and Space Administration, Greenbelt, MD). Mon. Not. R. Astron. Soc.; 170: No. 3, 497-501(Mar 1975).

The limiting efficiency is considered with which orbital angular momentum can be converted into rotational angular momentum, J_{rot}, of the mass-gaining component in binary systems which undergo mass exchange. This limit, $(dJ/dM)_{max}$, then specifies the maximum extent to which the observed rates of period change, dP/dt, can be affected by such reduction of orbital angular momentum. In most cases this process cannot seriously affect dP/dt, and therefore can be safely neglected in computing mass transfer rates and in comparing observed dP/dt values with evolutionary model calculations. Upon integrating $(dJ/dM)_{max}$ over the entire accretion process, it is found that the maximum accumulated rotational angular momentum is larger than the amount implied by the observed underluminosities of stars in certain extreme binary systems, by factors of 3 to 4. Shell stars and emission-line stars in binary systems may be produced when core angular momentum is later transferred into an envelope which already has nearly the limiting J_{rot}. (auth)

18019 RADIATIVE ACCELERATION IN THE NEIGHBORHOOD OF QUASI STELLAR OBJECTS. Kippenhahn, R.; Perry, J. J.; Roeser, H. J. (Goettingen Univ. (F. R. Germany). Sternwarte). Astron. Astrophys.; 34: No. 2, 211-224(Aug 1974).

The final velocities obtainable by a gas, in ionization and thermal equilibrium in the nonthermal radiation field of a QSO, which is accelerated by momentum absorption from this radiation field, as a function of plausible parameters of the QSO, such as its total luminosity and characteristic spectrum, and of the gas, such as its initial density and its expansion rate. With a simplified model the calculations for terminal velocities agree with observed absorption systems if QSO's are assumed to be at cosmological distances. (auth)

18020 ON THE MEASUREMENT OF THE MASS OF PSR 1913+16. Blandford, R. (Institute for Advanced Study); Teukolsky, S.A. Astrophys. J. Lett. 198: No. 1, L27-L29 (15 May 1975).

In an analysis of pulse arrival times the binary from the pulsar PSR 1913+16, the frequency shift due to the combined transverse Doppler effect and gravitational redshift cannot be distinguished from that due to the first-order Doppler effect as long as there is no secular variation of the orbital elements. However, the effects can be seperated in the presence of apsidal motion, allowing a measurement of the masses of PSR 1913+16 and its companion. We estimate that at least 5 years of regular observations will be required for a 10 percent measurement of the component masses. (auth)

18021 ISOLATED STRÖMGREN SPHERES AS A SOURCE OF GALACTIC Hα EMISSION. Elmergreen, B.G. (Princeton Unviersity Observatory). Astrophys. J. Lett. 198: No. 1, L31-L35 (15 May 1975).

The isolated Hα emission features reported by Reynolds *et al.* are identified with Strömgren spheres surrounding observed O stars; the root mean square electron densities and Strömgren radii are calculated from the observed emission measure and stellar type. The density has an average value of 2 cm^{-3} but increases to 3.3 cm^{-3} for stars within 200pc of the galactic plane. An analysis of the *Catalogue of Galactic O Stars* shows that enhanced Hα emission is observed around all known O stars. The diffuse component of Hα emission is what one would expect from the line-of-sight overlapping of isolated Strömgen spheres surrounding B stars and appears to correlate with features on extinction maps, as derived. There is no compelling reason to suggest any large-scale intercloud ionization from Hα data alone. (auth)

18022 MASS LOSS OBSERVED IN THE ULTRAVIOLET SPECTRUM OF THE A2 SUPERGIANT, ALPHA CYGNI. Kondo, Y.; Morgan, T.H. (NASA Johnson Space Center, Houston); Modisette, J.L. Astrophys. J. Lett. 198: No. 1, L37-L39 (15 May 1975).

High-resolution observations of the Mg II resonance lines and nearby subsidiary absorption features in the spectrum of α Cyg (A2 Ia) have been obtained. The resonance lines show a broad, asymmetric absorption extending almost 3 Å shortward of the reference wavelength, indicating a large-scale mass loss and a slight asymmetry in the line bottom which could be due to emission. A number of nearby weaker absorptions have been tentatively identified. Comparison with existing theory suggests that the added absorption arises in an extended envelope or shell maintained by a mass loss of the order of 10^{-8} to $10^{-10} M_{\odot}\ yr^{-1}$, but the development of a theory predicting the full line shape will be required to interpret fully the observations. (auth)

18023 SPECTROPHOTOMETRIC OBSERVATIONS OF MU CEPHEI AND THE MOON FROM 4 TO 8 MICRONS. Russell, R.W.; Soifer, B.T.; Forrest, W.J. (Department of Physics, University of California, San Diego). Astrophys. J. Lett. 198: No. 1, L41-L43 (15 May 1975).

We have obtained the first 4–8 μ spectrophotometric observations ($\Delta\lambda/\lambda \sim 0.01$) of μ Cep and the Moon, using the NASA Airborne Infrared Observatory. The lunar spectrum shows nongray behavior from 6.5 to 8μ. The spectrum of μ Cep, an M2 Ia star with circumstellar emission, shows no evidence for circumstellar excess from 4 to 8μ; we conclude that silicates provide the only infrared-active component of the circumstellar material. (auth)

18024 MODE OF PULSATION OF MIRA VARIABLES. Wood, P. R. (Univ. of Sussex, Eng.). Mon. Not. R. Astron. Soc.; 171: No. 1, 15P-16P(Apr 1975).

The variation of the period of Mira variables along the old disk giant branch observed by Eggen is used to produce a (period, Q) diagram. A comparison with theoretical calculations shows that the Mira variables of the old disk population are first overtone pulsators. (auth)

18025 HIGH DISPERSION Hβ SPECTROSCOPY OF SIX SOUTHERN WHITE DWARFS. Bessell, M. S.; Wickramasinghe, D. T. Mon. Not. R. Astron. Soc.; 171: No. 1, 11P-14P(Apr 1975).

Twenty Å mm^{-1} coudé spectra of the white dwarfs EG 141, CD -38° 10980, EG 62, EG 21, EG 99 and EG 131 have been obtained at Hβ. All except the latter two have sharp non-LTE line cores similar to those found in Wolf 1346 and 40 Eri B suggesting slow rotation. A number of low dispersion spectra of EG 131, previously classified as DA_{wk}, have failed to reveal any evidence of hydrogen line absorption. (auth)

18026 CONTINUOUS ABSORPTION COEFFICIENT OF THE NEGATIVE OXYGEN ION IN THE INFRARED. John, T. L.; Williams, R. J. (University Coll. of South Wales, Cardiff, Eng.). Mon. Not. R. Astron. Soc.; 171: No. 1, 7P-9P(Apr 1975).

The free-free continuous absorption coefficient of O^- is determined with accurate configuration interaction wave functions. The results show that O^- is probably below the threshold of detectability in infrared stellar spectra. (auth)

18027 QUASAR ABSORPTION SPECTRA. Radiative Interactions Between Absorbing Clouds and the Origin of Redshift Doublets. Rees, M. J. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 171: No. 1, 1P-5P(Apr 1975).

Some implications of recent high-dispersion spectra of PKS 0237-23 are discussed. In particular, a mechanism is proposed whereby the observed redshift doublets with characteristic splitting $\Delta z \simeq 0.0012$ could arise. (auth)

18028 FURTHER OBSERVATIONS OF THE ORION NEBULA CLUSTER. Penston, M. V. (Royal Greenwich Observatory, Hailsham, Eng.); Hunter, J. K.; O'Neill, A. Mon. Not. R. Astron. Soc.; 171: No. 1, 219-234(Apr 1975).

New spectral types for 16 stars, UBVRI photometry for 13 stars and UBVRIHKL photometry for 35 stars in the Orion Nebula cluster are presented. Analysis of this data together with those of Penston (1973) shows the reddening law in the cluster is normal. Previous claims for high ratios of total to selective absorption are caused by mistaking infrared emission for a hole in the absorption at that wavelength. The distance modulus of M42 is 8.0 ± 0.1 mag. Star formation in the cluster has been in progress over the last 10^7 yr. The infrared colours of cluster stars are correlated with their range of variation in the optical. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 17940, 17987, 18114, 18155, 18163, and 18383.

18029 (AD/A-002236) VLBI OBSERVATIONS OF OH/IR STARS. Reid, M. J.; Muhleman, D. O. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 13p. NTIS $3.25.

Very long baseline interferometric observations of 5 type II OH/IR objects indicate that the apparent size of the masering regions are about or greater than 0.1 seconds of arc. The present observations, combined with current theories, indicate that the 1612 MHz OH maser associated with Mira variables originates in the outer regions of the circumstellar dust. (GRA)

18030 (AD/A-002237) MODEL FOR THE 1612 MHz MASERS IN OH-IR STARS (13). Elitzur, M.; Goldreich, P.; Scoville, N. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 51p. NTIS $4.25.

The essential features responsible for the inversion of the 1612 MHz transition in OH-IR stars are covered based on earlier investigations of the optical pumping process, and and earlier suggestion that OH masers might be pumped by the absorption of infrared radiation. (GHT)

18031 (AD/A-002691) GLANCING INCIDENCE OPTICS IN X-RAY ASTRONOMY: A REVIEW. Final Report. Underwood, J. H. (Aerospace Corp., El Segundo, Calif. (USA)). 6 Dec 1974. Contract F04701-7-C-0075. 35p. (SAMSO-TR-74-251). NTIS $3.75.

The use of various types of optical configurations for investigations in x-ray astronomy is discussed. Examples of instruments using these optical configurations are given. (GRA)

18032 (IC-73-113) ASTROPHYSICAL ASPECTS OF BLACK HOLES. Rees, M. J. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1973. 21p. INIS.

Observational techniques for discovering black holes, and their likely observable effects, are reviewed and discussed.

18033 (LA-UR-75-258) ARE QUASARS LOCAL. Terrell, J. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 21p. (CONF-750110-4). Dep. NTIS $4.25.

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975).

The problems of interpreting quasars as galaxies, at distances of billions of light-years, seem to be increasing with time and with observational knowledge. The incredibly large energy and brightness requirements, the very small size and thus high surface brightness required by their rapid fluctuations in luminosity, the recently-discovered radio-source separation speeds apparently much greater than the speed of light, their general lack of association with distant galaxies, and many other properties are all very difficult to explain on the basis of cosmological distance. The very local quasar model, involving much less massive and bright objects--perhaps similar to Type O stars--emitted at relativistic speeds by the center of our own galaxy, greatly eases these difficulties. Since such ejected objects also seem necessary to explain the similarly strange properties of radio galaxies, the emission of local quasars from some galaxies might be deduced on this basis alone. (6 figures) (auth)

18034 (N-74-35217) GAMMA-RAY ASTROPHYSICS. Stecker, F. W. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Sep 1974. 126p. (NASA-TM-X-70759; X-602-74-272). NTIS $9.50.

Gamma ray production processes are reviewed, including Compton scattering, synchrotron radiation, bremsstrahlung interactions, meson decay, nucleon-antinucleon annihilations, and pion production. Gamma ray absorption mechanisms through interactions with radiation and with matter are discussed, along with redshifts and gamma ray fluxes. (STAR)

18035 (N-74-35236) OBSERVATION OF SOFT X RAYS FROM EXTENDED SOURCES. Final Report. Catura, R. C.; Acton, L. W. (Lockheed Missiles and Space Co., Palo Alto, Calif. (USA). Research Labs.). 30 Jun 1974. 15p. (NASA-CR-140516). NTIS $4.00.

Efforts were directed toward surveying several supernova remnants for the emission of soft x-rays. Rather than attempt to detect such faint x-ray emission, the program was redirected to observe the spectrum and angular structure of the extended x-ray source in the Perseus cluster of galaxies and the supernova remnant Puppis A. An attempt was made to detect x-ray line emission from Puppis A with a Bragg crystal spectrometer. Observations provide evidence for the presence of x-ray line emission in the spectrum of Puppis A near .65 keV. (auth)

18036 (N-75-10883) RADIO RECOMBINATION LINE OBSERVATION OF THE CII REGION NGC2023. Knapp, G. R.; Brown, R. L.; Kuiper, T. B. H. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 36p. (AD-783983). NTIS.

The reflection nebula NGC 2023 has been observed at four frequencies in a study of its carbon recombination line emission. The observations show the recombination line region to be about 2 pc in diameter, with an average electron density of approximately 0.2/cc and electron temperature of approximately 20^0K. The electron density increases exponentially near the B1.5 star HD37903, the illuminating star of NGC 2023. The most reasonable interpretation of the observational results is that the carbon emission lines arise in a cold CII region surrounding HD37903. The coexistence of the CII region with a region of enhanced CO emission suggests that the CO in NGC 2023 may be excited by electron collisions. (GRA)

18037 POSSIBLE IDENTIFICATION OF ARIEL 1118-61. Fabian, A. C.; Pringle, J. E.; Webbink, R. F. (Cambridge Univ., Eng.). Nature (London).; 255: No. 5505, 208(15 May 1975).

Ariel 1118-61 is stated to be a transient x-ray source, discovered by the satellite Ariel V. The error box for its estimated position contains the long period Mira-type variable RS Cen, and it has been suggested that in the Mira-type variables o Ceti (Mira) and SY for the blue variable companion is a white dwarf illuminated by infalling material accreted from the strong wind of the M-type star. It is proposed that some transient x-ray sources are binary systems consisting of a compact object in orbit around a long period variable. The accretion rate of material on to the compact object is just the rate required to produce x-rays from a compact object. If the proposed identification with RS Cen is correct, the transient x-ray source would be expected to appear regularly with a period of 164 days, but eclipses may complicate this prediction. Such an identification would establish the identity of a new class of x-ray binaries, and such systems would offer an opportunity of studying the structure and dynamics of the atmospheres and winds of Mira-type variables. (UK)

18038 BROADENING OF PULSES DUE TO MULTIPATH PROPAGATION OF RADIATION. Williamson, I. P. (Cambridge Univ., Eng.). Proc. Roy. Soc. (London), Ser. A; 342: No. 1628, 131-147(25 Feb 1975).

Observations of pulsars at low radio frequencies (ca. 100 MHz) show that the pulses received are broadened in time, presumably because of multipath propagation in the interstellar medium. Uscinski's analysis of this effect, by means of a diffraction theory, is reworked here into a form which is readily compared with the results of a stochastic ray-path theory, and the two approaches are found to agree exactly. The reasons for this are investigated. The ray approach suggests a Monte Carlo method of calculating the pulse shape at points deeper into the scattering medium than is possible by the method Uscinski used. Pulse shapes are calculated in this way both for the configuration discussed by Uscinski, and also for the case in which a statistically uniform medium extends along the whole length of the line of sight. Deep inside the medium, the pulse shapes calculated agree well with the asymptotic solutions derived previously by the present author. The general problem for a non-uniform medium is also discussed. (auth)

18039 SPECTRA OF DIFFUSE OBJECTS NEAR THE ANDROMEDA NEBULA. Esipov, V. F.; Sharov, A. S. (Astronomical Inst., Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 444-445(1975).

Translated from Astron. Zh.; 51: No. 4, 750-752(1974).

Spectra in the range λ = 5500-7500 Å have been obtained for 20 diffuse objects in the vicinity of the Andromeda Nebula, primarily compact galaxies but also some possible globular clusters belonging to M31. Strong and moderate-intensity Hα and λ 6583 [N II] emission lines occur in four objects; faint and suspected lines in three others. Their red shifts range from 0.009 to 0.073. Emission lines tend to be more prominent in objects with smaller color indices. (auth)

18040 PHYSICAL CONDITIONS IN THE CRAB NEBULA. Bychkov, K. V. (Special Astrophysical Observatory, Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 420-425(1975).

Translated from Astron. Zh.; 51: No. 4, 712-720(1974).

The "two-component" model proposed for the Crab Nebula is further developed. In this model, long and narrow regions of "strong" ($\approx 10^{-3}$ Gauss) and "weak" ($\approx 10^{-4}$ Gauss) magnetic field coexist. The first has been present since the formation of

the Crab and emits the radio waves; regions of the second type are periodically ejected by the pulsar and produce optical and x-ray synchrotron emission. The two-component model can explain the observed "infrared peak" as a continuation of the x-ray spectrum. Strong and "weak infrared" fields of $(0.9-1.3) \cdot 10^{-3}$ and $3.3 \cdot 10^{-4}$ Gauss, respectively, would be consistent with the measured flux density of hard γ rays ($E_\gamma \geq 2.5 \cdot 10^5$ MeV). Between the infrared and the millimeter range the spectrum should exhibit a singularity because the high- and low-frequency radiation come from completely different regions. The detection of such behavior would, in particular, establish the minimum energy E_{min} of the electrons injected into the nebula. The absence of a singularity at radio frequencies implies that $E_{min} > 10^4$ MeV. The observed parallelism of the nebular and pulsar x-ray spectra indicates that the electron acceleration mechanism in the "cavity" between the nebula and the pulsar does not alter the particle spectrum. (GHT)

18041 BINARY PULSAR PSR 1913+16: MODEL FOR ITS ORIGIN. van Horn, H. M.; Sofia, S.; Savedoff, M. P.; Duthie, J. G.; Berg, R. A. (Univ. of Rochester, NY). Science; 188: No. 4191, 930-933(30 May 1975).

The existing observational data for the binary pulser PSR 1913+16 are sufficient to give a rather well-defined model for the system. On the basis of evolutionary considerations, the pulsar must be a neutron star near the upper mass limit of 1.2 solar masses. The orbital inclination is probably high and the mass of the unseen companion probably lies close to the upper limit of the range 0.25 M/sub mass/ to 1.0 M/sub mass/. The secondary cannot be a main sequence star and is probably a degenerate helium dwarf. At the 5.6-kiloparsec distance indicated by the dispersion measure, the magnetic dipole model gives an age of approximately 4×10^4 years, a rate of change of the pulsar period of P approximately 2 nanoseconds per day, and a surface magnetic field strength approximately 1/3 that of the Crab pulsar. The pulsar is fainter than an apparent magnitude V approximately +26.5 and is at least approximately 80 times fainter than the Crab pulsar in the x-ray band. The companion star should be fainter than V approximately +30, and a radio supernova remnant may be detectable near the position of the pulsar at a flux level of less than or approximately 10 janskys. Important tests of this model will be provided by more accurate measurement of P and by a careful search for a faint supernova remnant. (auth)

18042 ACCURATE POSITIONS AND IDENTIFICATIONS FOR ELEVEN OHIO SURVEY SOURCES. Warner, J. W. (Carnegie Inst. of Washington, DC); Assousa, G. E.; Balick, B.; Craine, E. R. Publ. Astron. Soc. Pac.; 87: No. 515, 103-106(Feb 1975).

Accurate radio positions and optical identifications are presented for some sources from the Ohio survey. (1 figure, 1 table, 10 references) (auth)

18043 UBVr SEQUENCES AND OBSERVATIONS OF OPTICALLY IDENTIFIED RADIO SOURCES. Craine, E. R.; Johnson, K.; Tapia, S. (Univ. of Arizona, Tucson). Publ. Astron. Soc. Pac.; 87: No. 515, 123-130(Feb 1975).

Photoelectric observations of eight optically identified radio sources and comparison stars in nearby fields are presented. Six of these objects have continuous spectra and may belong to the BL Lac class of variables. The reported observations indicate possible short-term, small-amplitude variations in some of the optical counterparts of the radio sources. (9 figures, 3 tables, 14 references) (auth)

18044 PUZZLING NEW EMISSION-LINE OBJECT IN CIRCINUS. Sanduleak, N. (Case Western Reserve Univ., Cleveland). Publ. Astron. Soc. Pac.; 87: No. 515, 147-148(Feb 1975).

A new emission-line object, showing unusual spectral characteristics, has been discovered in an objective-prism survey of the southern Milky Way. (1 figure, 4 references) (auth)

18045 FOUR-COLOR PHOTOMETRY OF OJ 287 DURING ITS RECENT THREE-MAGNITUDE DECLINE. Smith, A. G. (Univ. of Florida, Gainesville); Scott, R. L.; Leacock, R. J.; McGimsey, B. Q.; Edwards, P. L.; Hackney, R. L.; Hackney, K. R. Publ. Astron. Soc. Pac.; 87: No. 515, 149-151(Feb 1975).

The lacertid OJ 287 has undergone a five-year optical outburst from which it is still declining. Photographic UBV photometry throughout the declining phase has shown that the color of OJ 287 remained remarkably constant despite a 3-magnitude drop in brightness. There were, however, significant short-term excursions about the mean color, which is represented by the indices (U–B) equals –0/sup m/65 and (B–V) equals 0/sup m/39. A smaller number of infrared (I) measurements show the same general trend. (3 figures, 11 references) (auth)

18046 THE IDENTIFICATION OF ABSORPTION REDSHIFT SYSTEMS IN QUASAR SPECTRA. Aaronson, M.; McKee, C.F. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory); Weisheit, J.C. Astrophys. J. 198: No. 1, 13-30 (15 May 1975).

A computer code has been developed to identify absorption redshift systems in quasar spectra. The code searches for candidate systems, and uses a coherent set of atomic physics and ionization equilibrium criteria to accept or reject each candidate. In addition, the code generates and analyzes large numbers (~500) of random spectra which are used to accurately determine the probability that an accepted system identified in the real spectrum is due to chance. The published spectra of eight quasars have been reexamined: 4C 05.34, PHL 957, PKS 0237–23, 1331+170, Ton 1530, 3C 191, PHL 938, and Mar 132. Fifteen systems appear well established, while nine more are suggested as possible. The existence of many previously identified redshift systems has been confirmed (none of the probable and only three of the possible systems are new), but our results indicate that the total number of well-established redshifts is substantially smaller than previously suspected. In particular, many of the systems proposed for 4C 05.34 and PHL 957 are now found to be statistically insignificant. These conclusions rest upon the use of a nonuniform spread of absorption wavelengths in the random spectra, in accord with the real spectra. The distribution of absorption redshifts z_a in well-established Class II systems (those with z_a significantly less than the emission redshift z_e) is consistent with the statistical predictions of the cosmological hypothesis for both steady state and Friedmann cosmologies; on the other hand, certain values of $(1+z_e)/(1+z_a)$ appear favored and are suggestive of "line locking." However, the present sample is too small to clearly favor either the intrinsic or cosmological hypothesis as the correct explanation for the origin of Class II redshifts. Evidence for the presence in some spectra of lines arising from excited fine-structure states, neutral species, and molecular hydrogen is discussed. Alternative explanations for the large fraction of unidentified lines are considered. We conclude that a number of these lines are probably members of additional redshift systems, but this cannot be proven until spectra of greater resolution are available. (auth)

18047 DOUBLET STRUCTURE IN THE ABSORPTION REDSHIFTS IN THE SPECTRUM OF PKS 0237–23. Boksenberg, A. (Physics Department, University College, London); Sargent, W.L.W. Astrophys. J. 198: No. 1, 31-43 (15 May 1975).

The spectrum of the quasar PKS 0237–23 has been observed over the wavelength range λλ3730–4300 at a resolution of 0.17 Å with the University College London image photon counting system. A list of 75 absorption lines has been combined with a further 26 lines drawn from other sources and identified by computer using a procedure described by Bahcall. Two new redshift systems, a complex of redshifts near $z_{abs}=1.55$ and a system at $z_{abs}=2.1758$, were found. The systems $z=1.51$, 1.59, 1.65, and 1.67 discovered by earlier workers were all found to be double or multiple; in addition, the system $z_{abs}=1.36$ may be double. A constant splitting, $\Delta z=0.0012$, between adjacent redshifts, corresponding to 141 ± 9 km s^{-1} in velocity, occurs at least seven times. The origin of this splitting, which also occurs in the quasars Markarian 132 and Ton 1530, is not understood. It almost corresponds, however, to the splitting between Lα, λ1215.67 and the nearby line λ1215.14 of He II. This amounts to 130.8 km s^{-1}. Most of the absorption lines are unresolved and have widths corresponding to velocity spreads of less than 50 km s^{-1} in the rest frames of the absorbing clouds. There is evidence for absorption line-locking involving superpositions of the lines of the C IV resonance doublet in nearby redshift systems. (auth)

18048 EMISSION-LINE STRENGTHS AND THE CHEMICAL COMPOSITIONS OF QUASI-STELLAR OBJECTS. Chan, Y.T. (Department of Astronomy, New Mexico State University); Burbidge, E.M. Astrophys. J. 198: No. 1, 45-55 (15 May 1975).

Estimates of emission-line strengths in 160 QSOs are listed. They are used, together with those for 60 objects published earlier, to compile a table of rest-frame equivalent widths for a composite QSO containing 28 lines seen in objects with z from 0.06 to 3.53. Models are computed for matter partially filling a spherical volume, ionized by ultraviolet flux from a central object and optically thick with absorption from heavy elements taken into account. Constant temperature and density are taken for the He II region, where most of the important lines are emitted. Allowance is made for lower and higher temperatures in the H I and He III regions. Emergent emission-line equivalent widths are computed and compared with the observations. An abnormally low helium abundance is not needed to achieve a fit, since the only anomalously weak line is He II c λ4686 whose upper level may be depopulated by stimulated emission of He II λ1215 caused by very strong Lα λ1216 flux. The results are very sensitive to the slope of the continuum for $\lambda < 912$ Å. There is no unique set of fitting parameters; ranges are possible. Values of the parameters μ and Y_{He} which give a reasonably good fit are $\mu = -0.8$ to -1.2, and $Y_{He}=0.03$ to 0.08, where μ is the spectral index of the ionizing radiation and Y_{He}=He/H by number. (auth)

18049 TIME-DEPENDENT EFFECTS IN THE RADIALLY STREAMING PARTICLE MODEL. Hubbard, R. (Department of

Physics, Bowling Green State University). Astrophys. J. 198: No. 1, 57-62 (15 May 1975).

The radially streaming particle model for broad quasar and Seyfert galaxy emission features is modified to include sources of time dependence. The results seem to harmonize with reported observations of multiple components, variability, and transient features in the wings of Seyfert and quasi-stellar emission lines. (auth)

18050 X—RAY HEATING AND THE OPTICAL LIGHT CURVE OF HZ HERCULIS. Perrenod, S.C.; Shields, G.A. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. 198: No. 1, 153-160 (15 May 1975).

We discuss theoretically the optical light curve of HZ Her, the binary companion of the pulsed X-ray source Her X−1. Using model stellar atmospheres, we construct light curves that are in agreement with UBV photometry of HZ Her except for the sharpness of the minimum. Unlike previous authors, we find that heating of the photosphere of HZ Her by the observed X-ray flux is sufficient to explain the amplitude of the light variations in each color, if the X-ray emission persists at HZ Her throughout the 35-day ON-OFF CYCLE. We rule out a corona surrounding HZ Her as the source of the extra light near minimum, and we also rule out a model wherein the extra light is caused by a stellar wind that electron-scatters optical light emitted by the photosphere of the hot side of the star. (auth)

18051 AN UPPER LIMIT ON OPTICAL PULSATIONS FROM SANDULEAK 160. Pennypacker, C.R. (Department of Physics, Harvard University); Lasker, B.M.; Bracker, S.B.; Hesser, J.E. Astrophys. J. 198: No. 1, 161-162 (15 May 1975).

SK 160, the optical counterpart of the X-ray star SMC X−1, has been searched for periodic optical pulsations from 0.1 to 500 Hz, setting an upper limit of roughly 0.1 percent on the modulation of the total optical flux. (auth)

18052 ULTRAVIOLET ABSORPTION LINES ARISING ON METASTABLE STATES. Noerdlinger, P.D.; Dynan, S.E. (Department of Astronomy and Astrophysics, Michigan State University). Astrophys. J. Suppl. Ser. 29: No. 283, 185-191 (June 1975).

We present a catalog and finding list of stronger ultraviolet (900−4000 Å) absorption lines arising on relatively low-lying metastable states of astronomically common ions. Applications to QSO absorption regions and extended stellar atmospheres are suggested. (auth)

18053 SOUTHERN HARD X-RAY SOURCES. Thomas, R. M.; Davison, P. J. N.; Clancy, M. C.; Buselli, G. (Tasmania Univ., Sandy Bay, Australia). Mon. Not. R. Astron. Soc.; 170: No. 3, 569-577(Mar 1975).

A re-analysis of University of Adelaide balloon data supports the conclusion that the dominant hard x-ray source in the Galactic Center is GX 1 + 4. Data are also presented for GX 354-5. The hard source Ara XR-1 is probably the Uhuru object 3U 1705-44 and is variable by a factor of at least 1.7 times (20 to 40 keV). Nor XR-1 is difficult to identify and in common with the rocket object Nor X-1, no convincing Uhuru candidate exists. Ambiguities in pre-Uhuru nomenclature are pointed out with regard to these sources. (auth)

18054 INVESTIGATIONS INTO REPORTED ANISOTROPIES IN RADIO SOURCE COUNTS AND SPECTRA AT 1421 MHz. Gillespie, A. R. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 541-549(Mar 1975).

New surveys at Cambridge show that there is no evidence for any significant anisotropies in the spectral index distributions or counts of radio sources at 1421 MHz, contrary to reports by other observers. (auth)

18055 COPERNICUS: THE X-RAY SPECTRUM pf PUPPIS-A. Charles, P. A.; Culhane, J. L.; Fabian, A. C.; Mitchell, R. J.; Zarnecki, J. C. (Mullard Space Science Lab., Dorking, Eng.). Mon. Not. R. Astron. Soc.; No. 3, 61P-65P(Mar 1975).

The MSSL x-ray telescopes on Copernicus have observed Puppis-A in the energy ranges 0.5 to 1.4 keV and 1.6 to 4.7 keV. The measured flux in the higher energy range is used with the spectral data from the lower energy range to determine the temperature of the remnant to be 8 ± 1 million degrees. A spectrum which includes line emission was used to establish this result, which is in agreement with the Pup-A observations of Gorenstein, Harnden and Tucker who use a similar spectrum. A power law gives a very poor fit to the data. No evidence is found for changes in spectrum across the source. (auth)

18056 VERY HIGH VELOCITY H I CLOUD IN THE DIRECTION OF M31. Davies, R. D. (Nuffield Radio Astronomy Lab., Jodrell Bank, Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 45P-49P.

A neutral hydrogen cloud with a velocity of −447 km s^{-1} relative to the local standard of rest has been discovered near the direction of the Andromeda nebula (M31). Observations with the Mark IA radio telescope (beamwidth 0.22 × 0.22°) show that its half-power dimensions are 0.40 × 0.36°; it is situated approximately 1.5°NW of the center of M 31. Alternative theories of the origin of this cloud are discussed. (auth)

18057 NON-VARIABLE 13.5 mm FLUX IN THE STRONG MILLIMETRE COMPONENT OF CENTAURUS A. Fogarty, W. G.; Schuch, N. J. (Univ. Mackenzie, Sao Paulo, Brazil). Nature (London).; 254: No. 5496, 124-125(13 Mar 1975).

It has been suggested that the "peculiar" galaxy and strong radio source Cen A has a strong and possibly variable component in the mm wavelength region. The present authors do not support this, as a result of flux density observations made with the 13.7 m radiotelescope at the Itapetinga Radio Observatory. No evidence for variability at this wavelength was found. (UK)

18058 NEUTRINO PROCESSES AND QSOs. Tennakone, K. (Univ. of Sri Lanka, Vidyodaya, India). Nature (London).; 254: No. 5499, 399-400(3 Apr 1975).

Reference is made to the peculiar jets of matter that emanate from some galactic nuclei and from QSOs, including the galaxy M87 and the QSO 3C273. It is known that as a result of non-conservation of parity in weak interactions the neutrino processes associated with gravitational collapse of a galactic nucleus in the presence of a strong magnetic field can lead to ejection of matter from the nucleus in one direction, and it is suggested that the jets observed in M87 and 3C273 are a result of this mechanism. For the mechanism to be effective a large fraction of the material of the nucleus must be in the form of neutrons free to decay, and this requirement can probably be realized in these objects. (UK)

18059 DISTANCE TO CYGNUS X-1. Margon, B.; Bowyer, S.; Kraft, R. (Univ. of California, Los Angeles). Nature (London).; 254: No. 5499, 461(3 Apr 1975).

Comments are made on the paper by Cheng who reexamined the present authors' estimates of the distance to Cyg X-1 and considered them to be widely in error. The authors conclude that the overwhelming weight of observational evidence places Cyg X-1 at d > 2 kpc, regardless of its nature, in accordance with their estimates. (UK)

18060 NEUTRON STAR WOBBLE IN BINARY X—RAY SOURCES. Lamb, D.Q.; Lamb, F.K.; Pines, D. (Department of Physics, University of Illinois, Urbana); Shaham, J. Astrophys. J. Lett. 198: No. 1, L21-L25 (15 May 1975).

Calculations of the influence of accreting-matter torques on the free precession of neutron stars in close binary systems are summarized. To the extent that the flow of accreting matter is modulated by the wobble motion of the neutron star, there will be components of the accretion torque locked in phase with this motion. Such components can be very effective in exciting or damping stellar wobble. It is suggested that large-amplitude stellar wobble, which can result from certain matter flow patterns and types of accretion gate, may be responsible for some of the high-low X-ray states observed in binary X-ray sources, including the 35^d cycle in Her X-1. (auth)

18061 THE NATURE OF QUASARS. van den Bergh, S. (David Dunlap Observatory, University of Toronto). Astrophys. J. Lett. 198: No. 1, L1-L2 (15 May 1975).

Most elliptical galaxies occur in relatively rich clusters whereas the majority of Seyferts are field galaxies. It is pointed out that this difference might be used to find out whether quasars are generically related to giant ellipticals or to Seyfert galaxies. The fragmentary data that are so far available do not favor the view that quasars occur in cD galaxies. (auth)

18062 TWO NEW QUASARS NEAR GALAXIES. Arp, H. (Hale Observatories, Carnegie Institution of Washington, California Institute of Technology, Pasadena, California); Baldwin, J.A.; Wampler, E.J. Astrophys. J. Lett. 198: No. 1, L3-L5 (15 May 1975).

A quasar of magnitude $V=19.2$ and redshift $z=1.94$ is reported at a distance of 1'.6 from a galaxy whose apparent diameter is about 2'.0. A second quasar of magnitude $V=17.6$ and redshift $z=0.71$ is reported at a distance of 1'.3 from a galaxy whose apparent diameter is about 1'.5. Both quasars were discovered by noticing blue stellar objects close to galaxies which were companions of larger nearby galaxies. (auth)

18063 REDSHIFT DISPERSION IN THE X—RAY CLUSTER OF GALAXIES A1367. Tifft, W.G.; Tarenghi, M. (Steward Observatory, University of Arizona). Astrophys. J. Lett. 198: No. 1, L7-L8 (15 May 1975).

The redshift dispersion in the cluster of galaxies A1367 is shown to be consistent with the X-ray luminosity-redshift dispersion correction. (auth)

Solar Phenomena

Refer also to abstracts 17934, 17941, 18016, 18170, 18178, 18191, 18199, 18204, 18254, 18256, and 18268.

18064 (AD-786453) SEASONAL AND DIURNAL VARIATIONS IN THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE AT INVARIANT LATITUDE 54 DEGREES. Hawkins, G. S.; Klobuchar, J. A. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 28 Jun 1974. 51p. (AFCRL-TR-74-0294; AFCRL-ERP-482). NTIS $3.75.

Measurements of total ionospheric electron content (TEC) by Faraday rotation of radio waves are given for the period November 1967 to September 1973 for 136 MHz transmissions from the geostationary satellite ATS-3 observed at a sub-ionospheric invariant latitude of 54 degrees N. The diurnal curves showed the effects of solar radiation and particle precipitation. (GRA)

18065 (AD/A-000129) "PROGNOZ" SPACE OBSERVATORIES IN FLIGHT. Agalakov, V. S.; Karachevskii, V. N. Translated from Zemlya Vselennaya; No. 6, 50-53(1972). 15p. (FTD-HC-23-1456-74). NTIS $3.25.

Contents: the "Prognoz" space observatories in flight; Mars 2 and Mars 3 accomplishments. (GRA)

18066 (AD/A-000927) QUANTIZATION OF SOLAR XUV IMAGERY FROM SKYLAB. Final Report, 1 August 1973–30 September 1974. Linnerud, H. H. (Science Applications, Inc., Bedford, Mass. (USA)). Aug 1974. Contract F19628-74-C-0050. 46p. (SAI-74-501-BO; AFCRL-TR-74-0403). NTIS $3.75.

The project was initiated to assimilate and correlate various astrogeophysical measurements to allow the forecasting of solar activity (particularly increased activity). The launch of Skylab provided access to a new data base, solar extreme-ultraviolet (XUV) imagery, for potential enhancement of predictive capability. Described in detail are the operating parameters and data processing techniques employed by NASA in generating the XUV imagery. The program encountered and techniques developed to quantize the imagery for potential use in predicting solar activity are detailed. Recommendations are made as to ways in which the use of this data may be improved for further studies. (GRA)

18067 (AD/A-002287) RELATIONSHIP BETWEEN SOLAR FLARES AND SOLAR SECTOR BOUNDARIES. Dittmer, P. H. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). 23 Oct 1974. Contract N00014-67-A-0112-0068. 13p. (SU-IPR-597). NTIS $3.25.

A superposed epoch analysis of 1964–1970 solar flares shows a marked increase in flare occurrence within a day of (–+) solar sector boundaries as well as a local minimum in flare occurrence near (+–) sector boundaries. This preference for (–+) boundaries is more noticeable for northern hemisphere flares, where these polarities match the Hale polarity law, but is not reversed in the south. Plage regions do not show such a preference. (GRA)

18068 (AD/A-002345) STUDY OF THE MAGNETIC AND VELOCITY FIELDS IN AN ACTIVE CENTER. Final Contract Report, 15 February 1973–30 July 1974. Harvey, K. L.; Harvey, J. W. (Lockheed Missiles and Space Co., Palo Alto, Calif. (USA). Lockheed Palo Alto Research Lab.). 30 Jul 1974. Contract F19628-73-C-0184. 22p. (AFCRL-TR-74-0401). NTIS $3.25.

The magnetic fields and velocity fields between the chromosphere and photosphere are compared in detail, and the changes occurring in association with flares are investigated. Three aspects of the analysis are discussed: (1) Flare location and development relative to the magnetic and velocity field configuration, (2) slow or evolutionary changes in the magnetic and velocity field in relation to flare occurrence, (3) rapid changes (i.e., changes having time scales comparable to that of flares) in the magnetic and velocity field occurring at the times of flares. (GRA)

18069 (AD/A-002369) SKY BRIGHTNESS DURING ECLIPSES: COMPENDIUM FROM THE LITERATURE. Silverman, S. M.; Mullen, E. G. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 5 Aug 1974. 187p. (AFCRL-SR-180; AFCRL-TR-74-0363). NTIS $7.00.

A collection of sky brightness measurements during solar eclipses is presented with emphasis on photometric measurements. Abstracts and summaries of papers containing data, both visual and photometric, are presented, and the results of the data are summarized. (GRA)

18070 (AD/A-002373) RESEARCHES IN THE FIELD OF SOLAR RADIO NOISE AS WELL AS OPTICAL PHENOMENA CONNECTED WITH SOLAR ACTIVITY. Interim Scientific Report, 1 February 1972–30 June 1974. Jensen, E.; Elgaroy, O. (Institute of Theoretical Astrophysics, Oslo (Norway)). 30 Jun 1974. 18p. NTIS $3.25.

Observations of solar radio noise; spectra and positions of fast drift bursts; fine structure at decimetric wavelengths; generalized fast drift bursts; band structure in solar radio bursts; intermediate drift bursts; and solar abundances of chemical elements are discussed. (GRA)

18071 (AD/A-002382) RESEARCH STUDY ON DYNAMICS OF THE SOLAR ATMOSPHERE. Final Report, 1 January 1972–30 June 1974. Bell, B.; Menzel, D. H. (Harvard Coll. Observatory, Cambridge, Mass. (USA)). Jul 1974. Contract F19628-72-C-0146. 20p. (AFCRL-TR-74-0357). NTIS $5.75.

Studies carried out in magnetohydrodynamics and a new form of gravitational force are summarized. Coronal studies at two eclipses are described, an attempt to verify (with negative results) a finding by Gnevyshev that the sunspot cycle on the average has a double maximum is reviewed, and research in the general area of solar-terrestrial relations is covered. Relationships between the intensity of the extreme ultraviolet (EUV) emission-line corona, the level of geomagnetic activity, and the velocity of the solar wind are discussed. (GRA)

18072 (AD/A-002392) PRELIMINARY LOW-ENERGY SOLAR CHARGED PARTICLE PREDICTION TECHNIQUE. Gold, R. E.; Roelof, E. C. (New Hampshire Univ., Durham (USA). Dept. of Physics). 1 Oct 1974. Contract F19628-73-C-0070. 16p. (AFCRL-TR-74-0488). NTIS $3.25.

A technique was developed for the prediction of low energy solar charged particle fluxes near 1 AU. Solar flare optical and x-ray data are used to estimate the number of particles produced in the active regions. The magnetic polarity topology of the low corona is used to estimate the access of the accelerated particles to the interplanetary medium as a function of heliographic longitude. The injected particles follow magnetic field lines closely and the EQRH approximation is used to determine the coronal connection longitude. (GRA)

18073 (AD/A-002393) EPHEMERAL ACTIVE REGIONS IN 1970 AND 1973. Final Report (Part 1), 15 February 1973–30 July 1974. Harvey, K. L.; Martin, S. F.; Harvey, J. W. (Lockheed Missiles and Space Co., Palo Alto, Calif. (USA). Lockheed Palo Alto Research Lab.). 30 Jul 1974. 32p. (AFCRL-TR-74-0490). NTIS $3.75.

The spatial distribution of ephemeral active regions (ER), lifetime, solar cycle variation, and association with major active centers are reported. Primary consideration was given to the question of whether or not ER represent, in part, a new class of solar activity or are simply small active regions. (GRA)

18074 (AD/A-003400) ACTIVE REGION FLARE RATES AND 8.6 mm BRIGHTNESS TEMPERATURES. Withbroe, G. L.; Vernazza, J. E. (Harvard Coll. Observatory, Cambridge, Mass. (USA)). 1 Oct 1974. Contract F19628-74-C-0018. 4p. (AFCRL-TR-74-0519).

The relationship between flare rate and 8.6 mm brightness temperature was analyzed using data from 99 active regions present on the solar disk in 1969 and 1970. The rate of flaring appears to increase exponentially with 8.6 mm brightness temperature T_b, for $T_b < 9200$ K. For higher temperatures, the rate of flaring appears to remain nearly constant, independent of T_b. The resulting empirical relationship provides a quantitative means of estimating flare rates from an easily measured parameter, the 8.6 mm brightness temperature. (GRA)

18075 (COM-74-50190-361-2) SOLAR-GEOPHYSICAL DATA NUMBER 361, SEPTEMBER 1974. Part II (Comprehensive Reports). Data for March 1974, February 1974, and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Sep 1974. 31p. (SGD-361-PT-2). National Climatic Center, Asheville, NC 28801, $1.25.

Comprehensive data are provided for March 1974 and February 1974 on solar flares, solar radio waves, abbreviated calendar record, and regional flare index. (GRA)

18076 (COM-74-50190-362-1) SOLAR-GEOPHYSICAL DATA NUMBER 362, OCTOBER 1974. Part I (Prompt Reports). Data for September 1974, August 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Oct 1974. 123p. (SGD-362-PT-1; NOAA-74110708). National Climatic Center, Asheville, NC 28801, $1.25.

Prompt reports are given on data for September 1974 and August 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, spacecraft observations, solar proton monitoring, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic

rays, geomagnetic indices and radio propagation indices. This issue also includes an index for 1973 and 1974. (GRA)

18077 (COM-74-50190-362-2) SOLAR-GEOPHYSICAL DATA NUMBER 362, OCTOBER 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Oct 1974. 123p. (SGD-362-PT-2; NOAA-74110709). National Climatic Center, Asheville, NC 28801, $1.25.

Comprehensive data are provided for April 1974 and March 1974 on solar flares, solar radio waves, abbreviated calendar record, regional flare index, and magnetograms of geomagnetic storm. (GRA)

18078 (COM-74-50276-36) ATLAS OF EXTREME ULTRAVIOLET FLASHES OF SOLAR FLARES OBSERVED VIA SUDDEN FREQUENCY DEVIATIONS DURING THE ATM-SKYLAB MISSIONS. Donnelly, R. F.; Berger, E. L.; Busman, J. D.; Henson, B.; Jones, T. B. (World Data Center A for Solar-Terrestrial Physics, Boulder, Colo. (USA)). Oct 1974. 103p. (UAG-36; NOAA-74110707). National Climatic Center, Asheville, NC 28801, $0.55.

The 10-1030A impulsive solar flux enhancements of solar flares during the ATM-Skylab missions are presented. The extreme-ultraviolet (EUV) enhancements were observed via sudden frequency deviations (SFD), an ionospheric effect caused by the enhancement of ionospheric photoionization produced by EUV bursts. The SFD measurements were made at Sacramento Peak Observatory; Boulder, Colorado; Leicester, England; Huntsville, Alabama; and Hawaii. EUV bursts are reported for the period April 1, 1973 to February 8, 1974, which includes several solar rotations before the first manned mission of ATM-Skylab. (GRA)

18079 (JPRS-63323) SOLAR NEUTRINOS. Yavelov, B. E. Translated from Priroda; No. 7, 46-53(1974). 18p. NTIS $3.25.

The source of the sun's energy is discussed. The Davis neutrino detector is described. Neutrinos and the nature of the center of the sun are discussed. (GRA)

18080 (JPRS-63427) SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE. No. 336. Translated from Various Journals. 49p. NTIS $3.75.

The report contains notes on the solar stratosphere; measuring number of meteors at equator; sedimentation in tropical zone of Indian Ocean; magnetic anomalies of crest of Mid-Atlantic Ridge; structure of shelf in Barents Sea; spatial distribution of photoluminescence of sea water; geophysical studies in the North Fiji Basin; increase in noise immunity of echo sounders; notes on research on crustal movements; earthquake precursors discussed; recent movements of earth's crust; notes on solar activity; Tass update on continuing flight of Salyut-3 Station; method for studying ionization inhomogeneities in D Region. (GRA)

18081 (JPRS-63543) SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE. No. 337. Translated from Various Journals. 30p. NTIS $3.75.

Research is outlined on optical parameters of the Martian atmosphere and surface; dynamic processes in the solar corona; fine thermal structure of ocean; analysis of thousand spectra of ocean turbulence; wind distribution with height above ocean surface; small-scale turbulence in ocean; seasonal periodicity of earthquakes; vertical electric component of field of geomagnetic pulsations; interpretation of gravity anomalies dependent on three space coordinates; electric properties of lunar ground; magnetic field of Mars determined from satellite data; registry of charged particles from solar flares; thermal properties of lunar ground. (GRA)

18082 ELECTROMAGNETIC WAVES FROM SOLAR CORONA. Mishra, S. P.; Gwal, A. K.; Misra, K. D. (Banaras Hindu Univ., India). Indian J. Phys.; 48: No. 9, 816-825(Sep 1974).

The energy radiated by electrons in the Cerenkov mode for plasma waves is numerically obtained with special regard to solar coronal model. It is found that a slowly moving test charge radiates more energy and the effect of thermal motion in the plasma is to enhance the radiated energy. Furthermore, an estimate of differential scattering cross section in the solar corona is made. The scattering, however, depends upon the degree of scattering and length of inhomogeneity. The electromagnetic wave spectrum in the solar corona is computed with the help of the calculated scattering cross section and plasma wave spectrum. The present spectrum is compared with that of synchrotron radiation in the light of available experimental and theoretical results. It is demonstrated that for a certain frequency region of the spectrum the two are comparable. (22 refs, 4 figs) (auth)

18083 SOME CHARACTERISTICS OF GREAT SOLAR FLARES IN THE PERIOD 1957–1965. Ruzickova-Topolova, B. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 6, 345-352(1974).

Data on chromospheric flares, importance ≥2, for the period 1957–1965 were treated statistically using Dolginova's catalogue (1972). The average values of the observed parameters of flares are discussed i.e., the overall duration, the time of the rise to flare maximum, the intensity, the area and the width of the H-alpha line at the time of maximum development. The distribution of the observed flares on the solar disk is investigated, as well as the E–W and N–S asymmetries in the occurrence of flares. The results, obtained for the individual importances, as well as for the whole set, are compared with the values, determined by Kopecká and Kopecký (1971) in treating large flares, observed up to 1956. The differences in the values of the average parameters, resulting from the comparison, can be explained, on the one hand, by gradual improvement in observation techniques as a result of introducing the Solar Patrol Service and of new methods of observation, and by the shift in the scale of estimating the importance, on the other. As regards the flare distribution over the solar disk there is a minimum close to the central meridian, and only the largest flares (3,3+) display a maximum there. The E–W asymmetry in flare occurrence during the period investigated is low, the N–S asymmetry displays considerable positive values and, in comparison with earlier cycles of solar activity, an increasing tendency. (auth)

18084 COLD EMISSION IN THE SOLAR CORONA. Alikaeva, K. V. (Galvnaya Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 26, 87-91(1975). (In Russian).

The faint emission of hydrogen, helium and metals in the corona which appears near an active prominence is studied. The calculations show that the temperature of the emission region is within the limits from 1100 to 30,000° and electron density—10^9—10^{10} cm^{-3}, respectively. (16 refs, 4 figs. (auth)

18085 SOME RESULTS OF THE STUDY OF PHOTOSPHERIC VELOCITY FIELD BY THE MODERATELY STRONG ABSORPTION LINES OF Fe. I. Kondrashova, N. N. (Galvnaya Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 26, 97-107 (1975). (In Russian).

The method of fine analysis for some moderately strong absorption lines was used to determine the dependences of turbulent velocity on the depth in the photosphere. The distributions obtained do not coincide with the dependences for the total amplitude of the photospheric velocity field on the depth derived from the study of weak absorption lines. An attempt is made to separate the micro- and macroturbulence, using various effects of the macroturbulence on the lines of different intensity. (7 refs, 2 figs, 1 table) (auth)

18086 INTENSITIES RATIOS OF HELIUM AND HYDROGEN LINES IN QUIESCENT PROMINENCES. I. Homogeneous Structure with Variable Electron Density. Morozhenko, N. N. (Galvnaya Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 26, 69-77(1975). (In Russian).

Variation in intensity ratio is considered for helium and hydrogen lines in quiescent prominences of various brightness. The observations are compared with calculations obtained for the model of prominence with a homogeneous structure and variable electron density. The calculations are in good agreement with the observations of prominences of faint and moderate brightness. But for bright prominences a systematic divirgence takes place, which is explained by shortcomings of the accepted model of a homogeneous structure. (20 refs, 5 figs, 2 tables) (auth)

18087 CENTER-TO-LIMB CHANGES OF THE PROFILES OF WEAK FRAUNHOFER LINES. IV. Interpretation of the Widths of Various Lines at the Solar Disk Center. Gurtovenko, E. A. (Galvnaya Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 26, 78-86(1975). (In Russian).

To study the parameters deduced from the Fraunhofer line profiles, the lines which are not affected by superfine HFS and isotopic IS structure should be used. The careful analysis of the profiles of lines for the elements Ti, Fe, Si, Cr, Ca, O, C, Zn, Mg, N, S, Ni, Sc resulted in deducing the radial component V^{rad}] for the amplitude of the photospheric velocity field is within the optical depth interval of $0.1 \leq \tau_s \leq 1.9$. The value of V^{rad} increases from 1.7 to 3.5 km/sec to the depth $\tau_s \approx 1.2$, and then decreases smoothly. (27 refs, 1 fig, 2 tables) (auth)

18088 DETERMINATION OF THE SOLAR WIND VELOCITY FROM PULSATION INDICES. Vero, J. (Geodetical and Geophysical Research Inst., Sapron, Hungary). J. Atmos. Terrest. Phys.; 37: No. 3, 561-564(Mar 1975).

An effort is made to deduce solar wind velocities from geomagnetic pulsation indices. It is shown that it is possible to determine the daily solar wind velocity from the pulsation data of a single observatory with smaller mean square error (about ±60 km/sec) than from Σ Kp or Σ Ap. (auth)

18089 EFFECT OF ALFVENIC FLUCTUATIONS ON THE SOLAR WIND. Chien, T. H. Washington, DC; Catholic Univ. of America (1974). 131p. University Microfilms Order No. 75-13,624.

Thesis (Ph. D.).

The major source of microscale fluctuations in the interplanetary medium due to the outwardly propagating Alfven waves is considered. The effect of the Alfven waves on the supersonic expansion of the solar wind is studied under the assumption that the motion of the interplanetary medium can be resolved physically into a comparatively smooth and slowly varying mesoscale flow and field with very irregular disordered incompressible microscale Alfvenic fluctuations superposed on it. The important features of the solar wind such as heat conduction flux, spiral interplanetary magnetic field, and proton thermal anisotropy are included in the theory. For inviscid, steady state, spherically symmetrical model of the solar wind, the two-fluid formulation of the background mesoscale MHD equations is obtained. The results show that during the expansion process, fluctuation energy is converted into the kinetic energy of the solar wind. Due to the presence of the Alfvenic fluctuations, the velocity of the solar wind is about 5 percent higher than that without considering the fluctuations. (Diss. Abstr. Int., B)

18090 SOLAR PARTICLE EVENTS WITH ANOMALOUSLY LARGE RELATIVE ABUNDANCE OF ^{3}He. Serlemitsos, A.T.; Balasubrahmanyan, V.K. (Laboratory for High Energy Astrophysics, NASA/Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. 198: No. 1, 195-204 (15 May 1975).

Experimental results on three solar energetic particle events with extremely high abundance of ^{3}He are reported. These events took place during 1969 May 28–29. The measurements, using the Goddard cosmic-ray telescope on board the OGO-5 satellite, cover an energy range of $\sim$4–80 MeV nucleon^{-1}. In the first of these events Γ (^{3}He/^{4}He) $=1.52\pm0.1$ (where Γ is the ratio of the two species in an energy per nucleon representation). In the two subsequent events Γ (^{3}He/^{4}He) had values of 0.71 ± 0.06 and 0.35 ± 0.03, respectively. The abundance of protons relative to He nuclei was significantly low in these events. Not more than four ^{2}H and three ^{3}H were detected during the entire period under study, compared with 1110 ^{3}He nuclei. The lower limits of Γ (^{3}He/^{2}H) obtained for these three events were 300, 250, and 63, respectively, and are much higher than the upper limits expected from theoretical considerations. Results from these events are compared with the data available from other experiments. The limitations these observations place on theoretical models to explain ^{3}He-rich flares are discussed. (auth)

18091 THE GENERATION OF MAGNETIC FIELDS IN ASTROPHYSICAL BODIES. X. MAGNETIC BUOYANCY AND THE SOLAR DYNAMO. Parker, E.N. (Department of Physics and Department of Astronomy and Astrophysics, University of Chicago). Astrophys. J. 198: No. 1, 205-209 (15 May 1975).

The magnetic field appearing as bipolar magnetic regions at the surface of the Sun represents the lines of force from a general azimuthal field of the order of 10^2 gauss somewhere beneath the surface. The amplification time, as a consequenc of the nonuniform rotation, is of the order of 10 years. But magnetic buoyancy brings the azimuthal field up through much of the convective zone in a time rather less than 10 years, raising the question of where the azimuthal field can be retained long enough to be amplified. We show that magnetic fields can be retained for long periods of time in the stable radiative region beneath the convective zone, but unfortunately the solar dynamo cannot function there because turbulent diffusion is an essential part of its operation. The only possible conclusion appears to be that the dynamo operates principally in the very lowest levels of the convective zone at depths of 1.5×10^5 km or more, where the gas density is 0.1 g cm^{-3}, and the fields are limited to 50 gauss, rather than the usually estimated 10^2 gauss. (auth)

18092 NONISOTHERMAL MAGNETOSTATIC EQUILIBRIA IN A UNIFORM GRAVITY FIELD. II. SHEET MODELS OF QUIESCENT PROMINENCES. Low, B.C. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado). Astrophys. J. 198: No. 1, 211-217 (15 May 1975).

We use the mathematical formulation of Low to construct magnetostatic models of the quiescent prominence in the form of a vertical infinite sheet of material which is both denser (at 1.67×10^{-13} g cm^{-3}) and cooler (at 5000 K) than its surrounding. A magnetic field of the order $(8\pi p_e)^{1/2}\sim2$ gauss serves to support the weight of the prominence and to confine the prominence material in a thin sheet. By a suitable choice of a certain free function in the mathematical model, the variation of the prominence temperature corresponds to a medium with a 5.2 power-law thermal conductivity, neglecting the magnetic effect on thermal conduction. It is shown that a static balance obtains everywhere between the conducted heat input and a hypothetical heat sink which is proportional to the local material density. This heat sink simulates the effect of the radiative loss of the prominence. The gross observed prominence features are reproduced. In particular, we find that a prominence sheet of thickness 100 km may be approximated by an isobaric model in spite of the presence of the ambient 2 gauss magnetic field. This is a first attempt at considering both questions of magnetostatic support and energy transport of the quiescent prominence. (auth)

18093 A METHOD FOR DERIVING RADIAL BRIGHTNESS DISTRIBUTIONS FROM ECLIPSE OBSERVATIONS. Hagen, J.P.; Swanson, P.N. (Department of Astronomy, The Pennsylvania State University). Astrophys. J. 198: No. 1, 219-222 (15 May 1975).

A method for calculating the radial brightness distribution of an eclipsed object by using the slope of the eclipse curve is presented. It is shown that the brightness temperature of a circularly symmetric eclipsed object is related to the slope of the eclipse curve and to the rate of change of the eclipsed area; the rate of change of the eclipsed area may be expressed simply in terms of the sine of a polar angle. The method is applicable to any eclipsing objects with circular cross section. It is particularly useful in the case of radio observations of a solar eclipse. (auth)

18094 SOLAR FLARE X-RAY POLARISATION. Mandel'stam, S. L.; Beigman, I. L.; Tindo, I. P. (Inst. of Physics, Moscow). Nature (London).; 254: No. 5499, 462(3 Apr 1975).

Comments are made on the paper by Brown who states that the Intercosmos-1 and Intercosmos-4 results of solar flare x-ray polarisation measurements are in error due to incorrect normalisation procedure to eliminate the effect of possible differences in the sensitivity of the photon counters and based on the assumption that the x-ray flux is unpolarised during the decay stage of the flare. In other experiments the counters were mounted on a rotating drum, permitting continuous checking of the relative sensitivities and eliminating the need for normalisation. (UK)

18095 PHOTOMETRY OF MOUSTACHES. Babin, A. N. Izv. Krym. Astrofiz. Observ.; 52: 88-91(1974). (In Russian).

The results of the photometry of moustaches observed with the modernized Crimean coronograph in $H_\alpha \pm 1$ Å light are presented. It was found that moustaches brighten and disappear with approximately equal rate (during 2 to 3 minutes). In the main phase of the moustache's life its brightness shows pulsations, but the reality of this phenomenon is open to question and could be tested by means of observations with the control of the image contrast and the seeing. Maximum intensities were found to be about 1.6 times that of the undisturbed background observed at the same wavelength. (2 figs., 9 refs.) (auth)

18096 VARIATIONS OF TWO-LEVEL MAGNETIC FIELDS AND H_α-OBSERVATIONS OF THE SPOT GROUP ON AUGUST 18–30, 1971. Babin, A. N.; Kartashova, L. G.; Koval, A. N.; Ogir, M. B.; Stepanyan, N. N. Izv. Krym. Astrofiz. Observ.; 52: 92-99 (1974). (In Russian).

The H_α observations of the spot group, passing across the solar disk on August 18–30, 1971, and measurements of magnetic field strengths made in two spectral lines (Fe I λ6302 and Ca I λ6103) were carried out in the Crimean astrophysical observatory. The analysis of all observing data had shown that: (1) all active centers in the group are associated with contact lines of the fields having opposite polarities; (2) the increase of activity takes place at the time of appearance of new magnetic hills and spots. The activity increases during the separation of the nuclei of opposite polarity from the main spot; also, (3) before the appearance of a flare, the field strength of spots near the flare region is higher at the upper level (measured in line λ6103) than at the lower one (measured in line λ6302). After the flare the magnetic field decreases at the upper level; and (4) the magnetic field at the upper level during surges and arc filament systems also increases. (8 figs, 11 refs) (auth)

18097 SOME PECULIARITIES OF THE METAL EMISSION LINES IN FLARES AND MOUSTACHES. Koval, A. N. Izv. Krym. Astrofiz. Observ.; 52: 100-112(1974). (In Russian).

The splitting of metal emission lines in flares is investigated. It is shown that the splitting observed in some metal emission lines cannot be due to the magnetic field, because the spectrograms of the 2b-importance flare in the D_1 and D_2 Na I lines obtained with Wollaston's prism and $\lambda/4$ plate show the same splitting in both polarized spectra. Slight shifts of the emission detected on the polarized spectra correspond to the magnetic field strength less than 1000 gs in the glare. The effect of the visibility of the Fraunhofer lines of the base through the emission core is examined. It is shown that the splitting of metallic lines in flares cannot be due to this effect. The photometric investigation of the Fe I lines showed that self-reversal of the optically thickest lines is the cause of their splitting. The excitation temperatures of the absorbtion layers in the two flares were found to be 6500 and 6000°. The investigation of the peculiarities of metal emission

lines in moustaches was continued. It is shown that the character of the emission in the metal lines is determined by the optical thickness of the emitting layer forming this line. (13 figs, 2 tables, 12 refs) (auth)

18098 BRIGHTNESS DISTRIBUTION IN EUV SPECTROHELIOGRAMS AND THE STRUCTURE CHANGES IN SOLAR ACTIVE REGIONS AS COMPARED TO QUIET REGIONS. Dubov, E. E.; Kartashova, L. G. Izv. Krym. Astrofiz. Observ.; 52: 113-130 (1974). (In Russian).

The brightness distributions in quiet (QR) and active (AR) regions in several EUV spectroheliograms (SHG) taken with the aid of OSO-IV and published by Reeves and Parkinson are considered. The results are given in figures and tables. The upper solar atmosphere is divided into 6 segments. The main conclusions are: the proper corona arises in AR at a higher temperature than in QR. Compared to QR, the layers with certain temperature have a greater temperature gradient dT/dh in AR and the respective layers are comparatively thin and lowered. In AR the dependence of lg [(dT/dh^{-1})] on lgT is steeper than in QR. Values of I(AR)/I(QR) have a well marked minimum near lgT = 5.2. There is difference in the correlations of brightness distributions in different SHG's for AR and QR. Fluctuations of brightness in AR are stronger. In AR the correlations of brightness fluctuations, between the SHG in the upper chromosphere lines and those in the coronal lines are appreciably more than between SHG's taken in lines of the transition zone and SHG's of coronal lines. The differences in brightness distributions for SHG in the coronal spectral lines of the transition zone are proved for AR as for QR. There are some peculiarities in brightness fluctuations near lgT = 5.2. In the model by Dubov, it is necessary to diminish 3-4 times the thickness of the upper chromosphere. For regions above the inner parts of supergranula it is necessary to increase the value of the temperature gradient near $(1-3)\cdot10^{5}$K. For AR the model should be modified to make all isotherms lower than in QR and each segment thinner. The only exception should be made for the upper chromosphere, because there dT/dh increases with T very steeply. (5 tables, 9 figures, 31 refs) (auth)

18099 FORECAST OF ACTIVE REGION DEVELOPMENT BY THE METHOD OF POTENTIAL FUNCTIONS. Slutskaya, T. L.; Stepanyan, N. N. Izv. Krym. Astrofiz. Observ.; 52: 131-140(1974). (In Russian).

Two problems of forecasting have been considered on the basis of plage observations from 1967 to 1969. I. The forecast of some properties of plage on the basis of observations of 4 parameters in the day of its birth on the solar disk. We can say with probability $P \geq 0.8$ whether the plage will (1) pass to the invisible hemisphere, (2) die on the disk, (3) pass from the invisible hemisphere and (4) whether we can expect flares in this plage. II. The forecast of the probability of the plage appearance from behind the limb in the next rotation on the basis of observation data of the plage born in this rotation (15 initial parameters). This problem was investigated by the method of potential functions with computer B9CM-6. Declination of forecasting probability of plage appearance (f*) from true value of forecasting function (y) is less than 0.3 for 84% of all plages. ($|f^* - y| < 0.3$) [Y = (1, if plage has passed from the invisible hemisphere and 0, if it has not)]. (3 fig, 4 tables, 12 refs) (auth)

18100 DISBALANCE OF MATTER FLOWS IN DEVELOPED ACTIVE REGIONS. Irgashev, J. I. Izv. Krym. Astrofiz. Observ.; 52: 141-147(1974). (In Russian).

The velocity fields at the photospheric level of five well-developed active regions located near the central meridian were studied. Photoelectric records of line of sight velocities obtained in the λ5250 Fe I line were used in this investigation. It is shown that downward gas flow predominates over upward gas flow in active regions occupied by sunspots. An increase of the area sunspot's umbrae and a decrease of the umbrae's splitting are followed by an increase of the gas flow instability observed in the overall active region. There is a connection between downward-to-upward flow ratios measured inside and outside of sunspots. This suggests the possibility of matter exchange between sunspots and their surroundings. (4 fig, 1 table, 19 refs) (auth)

18101 SOLAR COSMIC RAYS, DECAMETRIC RADIOBURSTS OF JUPITER, AND SOLAR WIND MERIDIONAL STRUCTURE. Vladimirskii, B. M.; Levitskii, L. S. Izv. Krym. Astrofiz. Observ.; 52: 158-162(1974). (In Russian).

Possible effects of solar proton flares in the decametric radio noise of Jupiter were considered. The observational data of Boulder for years 1960-71 were analyzed. It was shown that the planet's activity is increased after proton flares with one day delay. The effect is about 5 σ (standard deviation). It is present when the heliolatitude of Jupiter is >2°. It was concluded that the effect is probably similar to Earth's polar blackout. The avoidance zone in the propagation of solar protons is present at a distance up to 5 au. (2 figs, 10 refs) (auth)

18102 INFLUENCE OF EARTH HELIOGRAPHIC LATITUDE ON RECEIVING THE NOISE STORM EMISSION. Yurovskaya, L. I. Izv. Krym. Astrofiz. Observ.; 52: 163-170(1974). (In Russian).

Solar radio emission data at 100-260 mHz wavelengths 1956-1959 and 1967-1970 for periods of maximum solar activity are analyzed. It is found that a decrease of the noise storm numbers and the radio emission flux was observed in 1967-1970 in the heliographic latitude region -2 to -5°. Similar features of radio emission were observed in 1956-1959 in the heliographic latitude region -1.5° to +1.5°. The presence of a thin plasma layer (3° heliographic latitude) in high solar atmosphere near the equator affecting radio emission is concluded. A displacement of this layer for 3° to the south from the equator in 1967-1970 is noted. (2 tables, 5 figs, 10 refs) (auth)

18103 RADIO EMISSION FLUX DENSITIES OF THREE LOCAL SOURCES ON THE SUN AT WAVELENGTHS 1.9; 2.5; AND 3.5 cm. Bachurin, A. F.; Eryushev, N. N.; Tsvetkov, L. I. Izv. Krym. Astrofiz. Observ.; 52: 171-179(1974). (In Russian).

The one-day average values of the radio emission of three local sources on the Sun at wavelengths 1.9; 2.5 and 3.5 cm are given. The data include periods of observations from August 3 to August 6, 1972; from April 18 to May 1, 1973 and from May 14 to May 26, 1973 for local sources, associated with sunspot groups N 223, 83 and 96 [1-3] respectively. It is noted that the radio emission flux density of the local sources is closely associated with sunspot group areas. For sunspot groups N 83 and 96 the change of the flux density is well correlated with change of the visible area of the largest sunspot in the group. The values of the spectral index in the wavelength ranges 3.5-2.5 cm and 2.5-1.9 cm may be both equal and considerably different. The cases, when the spectral index values in the wavelength range 2.5-1.9 cm are greater than those of the wavelength range 3.5-2.5 cm, correspond to relatively high values of the sunspot areas and to those of radio emission intensity. The change of degree of radio emission polarization for the sunspot group N 96 is determined mainly by changes of the umbra area of the greatest sunspot in the group. (7 figs, 2 tables, 10 refs) (auth)

18104 LIMB-BRIGHTENING OF THE SUN AT SHORT CENTIMETER WAVELENGTHS. Bachurin, A. F.; Eryushev, N. N.; Tsvetkov, L. I. Izv. Krym. Astrofiz. Observ.; 52: 180-182(1974). (In Russian).

The ellipticity of the radio shape of the sun on wavelengths 3.5; 2.5 and 1.9 cm is revealed. It is assumed that this ellipticity may be explained as result of the solar limb-brightening. (3 figs, 1 table) (auth)

18105 RESEARCH OF SOME CHARACTERISTICS OF LOCAL SOURCES OF RADIOEMISSION ON THE SUN AT 0.8 to 1.7 cm WAVE RANGE. Efanov, V. A.; Moiseev, I. G.; Ryabov, M. I. Izv. Krym. Astrofiz. Observ.; 52: 183-189(1974). (In Russian).

The influence of the main parameters of active regions on the sun on the characteristics of local sources (sizes, bright temperature and flux) is studied at 8, 13 and 17 mm wavelength using the multiple correlation analysis. (1 table, 6 figs, 13 refs) (auth)

18106 SOLAR SPECTRUM AT 8 mm. Swanson, P. N.; Kuseski, R. (Pennsylvania State Univ., University Park). Nature (London).; 253: No. 5492, 513-514(13 Feb 1975).

Measurements were made of the slope of the brightness-frequency curve of the quiet sun near 36 GHz (λ = 8 mm), with a view to ascertaining whether the slope matches the van de Hulst model, according to which the disk temperature decreases with increasing frequency. The new moon was used as a calibration source, and it is suggested that future measurements of the solar brightness temperature at mm wavelengths should include measurements on the new moon, which serves as a stable calibration source outside the Earth's atmosphere, so that observations of the sun made with different instruments at different frequencies can be directly compared by considering their sun to new moon ratios. (UK)

18107 ON THE PLANETARY THEORY OF SUNSPOTS. Okal, E.; Anderson, D. L. (California Inst. of Tech., Pasadena). Nature (London).; 253: No. 5492, 511-513(13 Feb 1975).

It has been suggested that sunspot activity is affected by positions of the planets, and calculations have been presented that purport to show that planetary tides on the sun vary in a similar way to sunspot variations. The present authors believe that the apparent agreement is an artefact of the calculations, and the problem is examined for the tide-raising planets, Mercury, Venus,

Jupiter and the Earth, taking into account the complete orbital elements, including eccentricity, inclination, and their variation with time. (UK)

18108 SOLAR NEUTRINOS AND THE METHOD OF SPHERICALLY AVERAGED ROTATION. Prentice, A. J. R. (Monash Univ., Clayton, Australia). Mon. Not. R. Astron. Soc.; 170: No. 3, 67P-69P(Mar 1975).

A critical analysis of the method of spherical averages in rotating stars suggests that the neutrino flux is not nearly as badly underestimated as Monaghan has recently concluded and may even be actually overestimated in the case of stars possessing rapidly rotating cores. (auth)

18109 EXCITATION OF SEVERAL IRON AND CALCIUM LINES IN THE VISIBLE SPECTRUM OF THE SOLAR CORONA. Mason, H. E. (University Coll., London). MNRAA: No. 3, 651-664(Mar 1975).

New atomic data have been obtained for the coronal ions Fe X, Fe XI, Fe XIV, Ca XII, Ca XIII and Ca XV, using a computer package developed at University College, London. Energy levels and radiative transition probabilities have been computed allowing for configuration interaction and relativistic effects. The electron scattering problem has been solved using the "distorted wave" approach. All radiative and collisional processes contributing to the equilibrium equations for the ground configuration were considered, including cascade via the excited configurations and the effect of autoionizing levels on the electron collisional excitation rate. Wherever possible, the accuracy of the atomic parameters has been estimated and the results compared to those of previous authors. The atomic data, level populations and emission rates for the ions studied, are tabulated for various physical conditions appropriate to the solar corona. (auth)

18110 HYDROGEN-HELIUM INHOMOGENEITIES AND THE SOLAR NEUTRINO PROBLEM. Faulkner, D. J.; Da Costa, G. S.; Prentice, A. J. R. (Australian National Univ., Canberra). Mon. Not. R. Astron. Soc.; 170: No. 3, 589-597(Mar 1975).

Sixteen evolutionary sequences with various initial hydrogen-helium distributions have been constructed to test the ideas of Prentice that a configuration with a hydrogen-exhausted core of a few per cent of the Sun's mass surrounded by a hydrogen-rich burning region can give a marked reduction in the solar neutrino flux. It is found that such a configuration does give values <2 SNU, but that the configuration is not itself attainable in evolutionary sequences beginning with a central hydrogen deficiency. It is argued, in fact, that no initial abundance inhomogeneity can produce such a configuration at the solar age. On the other hand sequences with initial helium deficiencies in the central regions do give a reduction in the solar age neutrino flux—to ~3 SNU in the optimum case. There are now two types of inhomogeneity giving smaller neutrino flux values both of which involved the abundance of elements heavier than hydrogen increasing towards the solar surface. (auth)

18111 LONG TERM PERIODICITIES IN THE SUNSPOT CYCLE AND REPLY BY COHEN, T. J. AND LINTZ, P. R. Bain, W. C. (Science Research Council, Slough, Eng.). Nature (London).; 254: No. 5498, 362-363(27 Mar 1975).

Some comments are made on the paper by Cohen and Lintz, who claimed to have discovered the presence of a 179 year periodicity in sunspot cycles and interpreted this as a "beat" phenomenon between two more rapid oscillations. A reply by Cohen and Lintz is appended. (UK)

18112 RECORDING OF CHARGED PARTICLES FROM SOLAR FLARES IN JULY-AUGUST 1972 ON PROGNOZ-2. Blokh, G. M.; Volodichev, N. N.; Grigorov, N. L.; Kolesov, G. Ya.; Likin, O. B.; Morozova, E. I.; Pisarenko, N. F.; Savenko, I. A.; Suslov, A. A.; Ustinovshchikov, V. V. (Moscow State Univ.). Geomagn. Aeron. (Transl.).; 14: No. 4, 616-618(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 725-727(1974).

Several chromospheric flares were observed on the sun in July and August 1972 and some of the particles in these flares were accelerated to relativistic energies. The results of measurement of cosmic rays from these flares by instruments on board Prognez-2 are briefly examined. (1 figure) (SDF)

18113 SEQUENCE OF STRONG DISCONTINUITIES IN INTERPLANETARY PLASMA FLOW AND A GEOMAGNETIC STORM. Ivanov, K. G.; Evdokimova, L. V.; Mikerina, N. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 483-485(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 569-572(1974).

The properties and geomagnetic effect of a sequence of eight strong discontinuities in the leading edge of an interplanetary plasma flow are investigated. The importance of such investigations to space physics and forecasting is noted. (2 figures, 1 table) (auth)

18114 OBSERVATIONS ON THE OCCULTATION OF THE RADIO SOURCE TAURAS A BY THE SOLAR CORONA DURING JUNE 1971. Sastry, C. V.; Subrahmanyan, K. R. (Indian Inst. of Astrophysics, Kodaikanal). Indian J. Radio Space Phys.; 3: No. 3, 196-198(Sep 1974).

Observations on the occultation of the radio source Taurus A (3c 144) during June 1971 at a wavelength of 12m are presented. It is tentatively observed that there is no strong dependence between the amount of scattering and solar activity. (auth) (3 figs, 10 refs.)

18115 SOLAR FLARE EMISSIONS AND GEOPHYSICAL DISTURBANCES. Sakurai, K. (Goddard Space Flight Centre, Greenbelt, MD). Indian J. Radio Space Phys.; 3: No. 3, 289-312(Sep 1974).

Various geophysical phenomena are produced by both wave and particle emission from solar flares. In understanding these phenomena, it is necessary to investigate the nature of these emissions and solar flare phenomena. Using the observed data for these emissions, a review is given on the nature of solar flares and their development. Geophysical phenomena are discussed by referring to the results for solar flare phenomena. (32 figs, 190 refs, 5 tables) (auth)

18116 ANALYSIS OF CHROMOSPHERIC EMISSION LINES AT THE 1962 ECLIPSE. Groeneveld, R. C. Groningen, Netherlands; Groningen Univ. (1974). 106p.

Thesis.

An analysis is described of a number of emission lines in the chromosphere of the sun. There are indications of absorption in the solar chromosphere, at least in the strong lines. The observed dependence on height of the total intensity is approximated with a sum of two exponential functions. With some simplifying assumptions are calculated the emitted intensity of the lines in a spherically symmetric and homogeneous chromosphere with a Doppler profile for emission and absorption independent of height. A formula is derived for a height-independent source function. In a more sophisticated model, constant logarithmic gradients are assumed for the emission and absorption coefficients. Source functions and optical depths are calculated for a number of different logarithmic gradients. An attempt is made to explain the observed intensities. For titanium, a discrepancy is found between the source functions which can be derived from disk observations, and the limits on the source functions and optical depths which follow from the chromospheric observations. The excitation temperature in the chromosphere must be much higher than the disk values. A method is developed to derive the emission and absorption coefficients from the chromospheric measurements alone. This method is explained with the first multiplet of singly ionized titanium as an example. This method is applied also to the second, sixth and seventh multiplets of Ti^+. A comparison of the results for the four multiplets shows that a fairly good approximation to the observations can be found in the first-order analysis. The optical depth in a number of lines is computed. The strong lines are clearly affected by absorption. (NL)

Galaxies

Refer also to abstracts 18004, 18017, 18039, 18053, 18058, and 18061-18063.

18117 (AD-783983) RADIO RECOMBINATION LINE OBSERVATION OF THE CII REGION NGC2023. Knapp, G. R.; Brown, R. L.; Kuiper, T. B. H. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 36p. NTIS $3.25.

The reflection nebula NGC 2023 has been observed at four frequencies in a study of its carbon recombination line emission. The observations show the recombination line region to be about 2 PC in diameter, with an average electron density of approximately 0.2/cc and electron temperature of approximately 20K. The electron density increases exponentially near the B1.5 star HD37903, the illuminating star of NGC 2023. The most reasonable interpretation of the observational results is that the carbon emission lines arise in a cold CII region surrounding HD37903. The coexistence of the CII region with a region of enhanced CO emission suggests that the CO in NGC 2023 may be excited by electron collisions. (auth)

18118 (AD/A-002374) FAR INFRARED AND SUBMILLIMETER BACKGROUND. Final Report, 15 November 1969-31 December 1973. Houck, J. R.; Soifer, B. T.; Harwit, M. O.; Pipher, J. L. (Cornell Univ., Ithaca, N. Y. (USA). Center for Radiophysics and Space Research). 15 Mar 1974. Contract F19628-70-C-0128. 62p. (AFCRL-TR-0202). NTIS $4.25.

Contents: Rocket infrared observations of the interplanetary

medium; rocket measurement of the galactic background; rocket infrared 4-color photometry of the galaxy's central region; the far infrared and submillimeter background; and groundbased infrared photometry. (GRA)

18119 (LBL-3602) STATIC EQUILIBRIA OF THE INTERSTELLAR GAS IN THE PRESENCE OF MAGNETIC AND GRAVITATIONAL FIELDS. Mouschovias, T. C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1975. Contract W-7405-ENG-48. 217p. Dep. NTIS $14.00.

Thesis.

No exact self-consistent equilibrium calculations exist for (any model of) the system of the interstellar gas and the frozen-in magnetic field. On a large scale (approximately 1 kpc) this system is affected by the vertical galactic gravitational field, while on a small scale (approximately 1 pc) the self-gravitation of the gas comes into play and is responsible for the collapse of some clouds to form stars. Accessible equilibrium states are determined for the gas–field system on both of these scales. (JFP)

18120 (N-75-10879) ABSOLUTE SPECTROPHOTOMETRY IN M31 AND M32. Oke, J. B.; Schwarzschild, M. (Hale Observatories, Pasadena, Calif. (USA)). 1974. 25p. (NASA-CR-140683). NTIS $3.25.

For a number of places in the bulge of M31 and for two places in M32 photometric scans from 3300 A to 10,600 A have been obtained with the multichannel spectrometer on the 5-meter Hale telescope. The scans show that in both objects the color temperature (particularly shortwards of 5000 A) decreases towards the center and that the strength of the CN bands increases towards the center in both objects in agreement with earlier observations. The new data can all be interpreted in terms of an increase of heavy element abundance towards the center in both objects by a factor probably less than 2 and by an excess of heavy elements in M31 compared to M32 by a factor probably greater than 2, in qualitative agreement with earlier conclusions. (auth)

18121 (USIP-75-01) ANTIMATTER AND COSMOLOGY. Svaton, E. M. (Stockholm Univ. (Sweden). Fysiska Institutionen). Jan 1975. 37p. Dep. NTIS (US Sales Only) $5.00.

Thesis.

Klein, in order to derive the Eddington relations, proposed the thought that the universe did not start from a singularity but from a real physically realizable state and expanded due to some real natural causes. With the contributions of Alfvén, the Alfvén–Klein metagalactic theory, as it became to be called, introduces no new physical laws and assumptions except those that have beer verified in the laboratory; these are extended to be valid everywhere: thus antimatter, whose presence is a consequence of the charge symmetry principle verified in the laboratory on an elementary particle scale, is supposed to be present everywhere throughout the whole extent of the early metagalaxy. The problems encountered by the Alfvén–Klein theory are considered. (auth)

18122 SPHERICALLY SYMMETRIC COLLAPSE AND THE NAKED SINGULARITY. Banerjee, A. (Jadavpur Univ., Calcutta). J. Phys., A (London); 8: No. 2, 281-282(Feb 1975).

It is shown that spherically symmetric collapse of a dust cloud in some cases may lead to a naked singularity. (auth)

18123 GRADIENT DIAGRAM FOR OPTICAL VARIABLE NUCLEI OF GALAXIES AND QUASARS. Lukatskaya, F. I. (Glavnaya Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 26, 47-52(1975). (In Russian).

The V, B and U, B dependences are linear regressions for the simultaneous photoelectric observations of the optical variable nuclei of galaxies. The angular coefficient of those dependences or brightness gradients are determined for four N-galaxies and six Seifert galaxies and one flage of PKS 0537-441. (12 refs, 7 figs, 1 table) (auth)

18124 SPIRAL STRUCTURE AND THE DYNAMICS OF FLAT STELLAR SYSTEMS. Dekker, E. Leiden; Rijksuniversiteit (1975). 148p.

Thesis.

Two problems left over by the Lin and Shu theory are studied: how can spiral structures with longer lives than 10^9 years be explained; what determines the frequency of the spiral waves as observed? It is shown with the aid of numerical experiments that the gas through its interaction with the expanding wave exercises a stabilizing influence on that wave. This results in an equilibrium attained in about 5×10^9 years, in which the wave persists with a certain finite amplitude. A more sophisticated quasi-linear theory, inspired by kindred developments in plasma physics, confirms this result. However, it also shows that after a very long time—1 to 2×10^{10} years—the wave will be damped. The spiral structure originates in an instability in the stellar population. The final form and the amplitude of the density wave depend on the dynamical properties of the stellar disk, on the structure of the gaseous masses, and on the mass ratio between the gas and the stars. (auth)

18125 MOLECULES IN SPACE. Cook, A. H. (Cambridge Univ., Eng.). Q. J. R. Astron. Soc.; 16: No. 1, 21-38(Mar 1975).

A review is presented of the detection of molecules in space, of the development of information about the physics and chemistry involved, and of the implications of this information for astronomy. A table of the observed molecules shows the sites in space where they are found and the method of detection. The densities of some galactic molecules are shown. The account continues under the following headings: abundances of molecules (including a table of some ratios of carbon isotopes); mass of gas in the Galaxy; the background radiation; amplification by stimulated emission; the formation of molecules; and a final section discussing some special problems needing attention. (UK)

18126 HIGH FREQUENCY RADIO OBSERVATIONS OF THE STEPHAN'S QUINTET REGION. Kaftan-Kassim, M. A.; Sulentic, J. W.; Sistla, G. (State Univ. of New York, Albany). Nature (London); 253: No. 5488, 176-177(17 Jan 1975).

It is stated that observations of the Stephan's Quintet region, using the Westerbork Synthesis Radio Telescope at 1.415 GHz, suggest an arc-shaped source partially encircling a point source centered on NGC 7319. In observations with the National Radio Astronomy Observatory three-element interferometer, at frequencies of 2.695 and 8.085 GHz, the point source was detected at both frequencies, although appearing somewhat extended. A crescent shaped source was also clearly resolved at the lower frequency into two extended sources. The results of the 2.695 GHz observations are shown and are discussed. The observations did not show an arc structure, and possible reasons are given for the discrepancy from earlier results. Spectra are shown graphically for the three resolved sources and a fourth source detected about 5′ south preceding NGC7319. The most striking feature of the spectra is their steepness, and it is tempting to speculate that the extreme steepness of the spectra, together with the extended forms of the sources, may indicate that they are remnants of an earlier ejection, but that the source centered on NGC7319 is of a later epoch. (UK)

18127 TYPE AND SHAPE DIFFERENCES FOR ISOLATED AND PAIRED GALAXIES. Karachentsev, I. D.; Karachentseva, V. E. (Special Astrophysical Observatory, Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 428-431(1975).

Translated from Astron. Zh.; 51: No. 4, 724-729(1974).

The true-sphericity distribution $f(\epsilon)$ for elliptical and spiral galaxies is examined, using the authors' catalogs of 1051 isolated and 1206 double galaxies. Flat spirals (type Sc and Sd) with $\epsilon \approx 0.1$ are more common among isolated than paired galaxies, probably reflecting the segregation of stellar populations I and II in field galaxies and system members. Double galaxies include an excess number of systems with both components of the same morphological type. Markaryan galaxies occur three times more often in double systems than as isolated objects. (auth)

18128 GALAXY CLUSTERS ACCORDING TO THE LICK OBSERVATORY COUNTS. Fesenko, B. I.; Pit'ev, N. P. (Leningrad State Univ.). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 436-440(1975).

Translated from Astron. Zh.; 51: No. 4, 736-744(1974).

A method is proposed for investigating clusters of galaxies from galaxy counts in neighboring areas of the sky. In this method the numbers of galaxies within two fields on the same plate are compared. Several initial moments of the membership population are determined from the Lick Observatory counts. The effect of nonuniform absorption is eliminated. The results can be interpreted by adopting an s^{-3} law for the distribution of clusters with respect to the number s of members brighter than the limiting magnitude of the counts. When selection is taken into account the same law is obtained for the distribution of clusters with respect to the number t of members brighter than $M_0 + 3$, where M_0 is the absolute magnitude of the brightest member galaxy (M_0 is assumed independent of t). The mean value of t is 5.0. Probably most observed galaxies brighter than 19^m are leading members of very remote clusters whose other galaxies are unobservable. (auth)

18129 H I OBSERVATIONS OF DUST CLOUDS. Chu, K. W. Pasadena, CA; California Inst. of Technology (1975). 127p. University Microfilms Order No. 75-9520.

Thesis (Ph. D.).

Aperture synthesis observations of three dust clouds, L134, L1495 and L1517, were made at 21 cm. A 7 arc min diameter beam was synthesized, and the velocity resolution was 0.2 km/sec. In addition to interferometer observations, single dish measurements were carried out to provide large scale information. Two dust clouds, L134 and L1495, were detected in absorption against back-

ground 21 cm emission. In both cases the 21 cm absorption line is at a velocity coincident with molecular lines detected in the dust clouds. The hydrogen responsible for the absorption line has a spin temperature less than 20°K, and the columnar atomic hydrogen density through the dust clouds is between 10^{19} cm^{-2} and 10^{20} cm^{-2}. L134 consists of two velocity components separated by 2 km/sec. Within an individual velocity component, no significant substructure was detected in L134 or L1495. The optical appearance of L1517 strongly suggests a fragmented structure, but this dust cloud was not detectable at 21 cm. (Diss. Abstr. Int., B)

18130 OBSERVATION OF PULSED AND NON-PULSED GAMMA RADIATION FROM THE CRAB NEBULA NEAR 1 MeV. Gruber, D. E. San Diego, CA; Univ. of California (1974). 99p. University Microfilms Order No. 75-8259.

Thesis (Ph. D.).

Gamma-rays in the energy range 0.2 to 10 MeV have been observed from the Crab Nebula and its central pulsar, NP 0532, on three occasions in 1971. Besides confirming the continuous and pulsed emissions at low energy, the new observations indicate an additional flux above 1 MeV. The total Crab Nebula flux determined from the three flights gave average flux levels with a statistical precision of 3 sigma or better on each of four broad energy bands. The total Crab emission, including the pulsed part, follows an $E^{-2\pm2}$ law for number flux from the X-ray range to at least 150 MeV with a strong excess emission in the 1–10 MeV range. On the basis of the accepted model for nebular emission, a broad-band power-law spectrum of electrons must be continually injected to sustain the X- and gamma-ray emission. The 1–10 MeV excess nearly doubles the total electromagnetic luminosity of the Crab. Gamma radiation of nuclei following collisional excitation is felt to be the only reasonable mechanism for the 1–10 MeV excess. The net emission for several models is calculated and only emission from a very condensed region is seen as likely to produce a viable model. (Diss. Abstr. Int., B)

18131 RECENT REVELATIONS OF INFRARED ASTRONOMY. Stein, W. A. (Univ. of California, San Diego). Publ. Astron. Soc. Pac.; 87: No. 515, 5-16(Feb 1975).

A survey is presented of recent studies of astronomical objects emitting energy in the infrared. The topics of interest covered are: I, Protostars, and whether such forming stars have yet been observed; II, The condensation and composition of solid particles in the galaxy; III, The physical processes of the radiation mechanism of extragalactic sources; IV, Peculiar sources from the lambda equals 2 mu survey of Neugebauer and Leighton and from the lambda equals 4 mu, 11 mu, 20 mu survey of Walker and Price. (4 figures, 81 references) (GHT)

18132 OBSERVATION OF M31 AND M33 AT 1.4 AND 2.7 GHz. Dennison, B. (Cornell Univ., Ithaca, NY); Balonek, T. J.; Terzian, Y.; Balick, B. Publ. Astron. Soc. Pac.; 87: No. 515, 83-86(Feb 1975).

Radio contour maps of M31 and M33 at 1410 MHz and 2695 MHz are presented. At these frequencies most of the radio emission appears to be associated with the nuclear and spiral arm regions, and halo emission is not observed. The radio spectra of these galaxies are discussed. (3 figures, 11 references) (auth)

18133 THE SOFT X—RAY SPECTRUM OF THE PERSEUS CLUSTER. Davidsen, A.; Bowyer, S.; Lampton, M.; Cruddace, R. (Astronomy Department and Space Sciences Laboratory, University of California, Berkeley). Astrophys. J. 198: No. 1, 1-6 (15 May 1975).

The X-ray spectrum of the Perseus cluster in the range 0.1—4.0 keV has been observed. Contrary to the results of previous low-energy rocket observations, no large flux of soft X-rays was found. The X-ray spectrum from 0.1 to 56 keV is consistent with bremsstrahlung from an intracluster gas with $T \simeq 10^8$ K, attenuated by the interstellar column density inferred from 21-cm observations. The low-energy X-ray spectrum is not consistent with a nonthermal power-law model with the same slope as that observed at higher energies. The mass of hot intracluster gas required to produce the observed X-ray flux is a small fraction of the gravitational binding mass. The soft X-ray flux, when combined with limits on the radio flux, implies that the cluster is not gravitationally bound by ionized gas at any temperature. (auth)

18134 3C 411: A NEWLY DISCOVERED *N* GALAXY WITH A LARGE REDSHIFT. Spinrad, H.; Smith, H.E. (Astronomy Department, University of California, Berkeley); Huntstead, R.; Ryle, M. Astrophys. J. 198: No. 1, 7-11 (15 May 1975).

3C 411 (PKS 2019+09), normal extragalactic radio source at low galactic latitude, is identified with a variable, 20th magnitude *N* galaxy. It has a rich emission-line spectrum yielding a redshift $z=0.469$. We discuss quantitative spectroscopic criteria which tend to place 3C 411 between QSOs and normal radio galaxies, similar to the nearer *N* systems. A high-resolution synthesis radio map at 5 GHz shows a double-lobed source with a low-brightness connecting bridge, and a nuclear source centered over the optical object. (auth)

18135 ABSOLUTE SPECTROPHOTOMETRY IN M31 AND M32. Oke, J.B. (Hale Observatories. California Institute of Technology; Schwarzschild, M. Astrophys. J. 198: No. 1, 63-70 (15 May 1975).

For a number of places in the bulge of M31, and for two places in M32, photometric scans from $\lambda=3300$ Å to $\lambda=10{,}600$ Å have been obtained with the multichannel spectrometer on the 5—m Hale telescope. The scans show that in both objects the color temperature (particularly shortward of 5000 Å) decreases toward the center, and that the strength of the CN bands increases toward the center in both objects, in agreement with other, earlier observations. The new data can all be interpreted in terms of an increase of heavy-element abundance toward the center in both objects by a factor probably less than 2, and by an excess of heavy elements in M31 compared with M32 by a factor probably greater than 2, in qualitative agreement with earlier conclusions of other observers. (auth)

18136 INTERSTELLAR CN AT RADIO WAVELENGTHS. Turner, B.E.; Gammon, R.H. (National Radio Astronomy Observatory, Charlottesville, Virginia). Astrophys. J. 198: No. 1, 71-89 (15 May 1975).

Seven of the nine hyperfine lines in the 2.6-mm $K=1—0$ transition of CN have been observed in many interstellar sources. CN is detected in the direction of infrared sources (with and without associated H II regions), toward at least one star which shows interstellar lines of CH and CH^+, toward several objects regarded as protostellar in nature, but not in dark dust clouds or in several strong sources of HCN and HC_3N. Hyperfine transition frequencies are accurately determined by assuming CN velocities are those of several other millimeter-wavelength molecules in the 22 sources we have detected (of 45 searched). No significant violations of this assumption are found in any source. New, more accurate values are derived for the rotation constant, spin-doubling constants, and magnetic hyperfine and electric quadrupole coupling constants for the CN radical. The 2.6-mm lines of CN appear optically thin in many but not all sources. Analysis of excitation conditions rests on opacities derived from brightness ratios of hyperfine lines, as these lines appear "normally" excited. Derived total particle densities are typically 10 times less than have been estimated from excitation studies of other molecules (CS, HCN). This is understandable if radiative trapping is important in exciting CS and HCN. CN abundances appear inversely correlated with total densities in the range $\sim 10^4 \leqslant n_{H_2} \leqslant 10^6$ cm^{-3}. This, and the relative abundances of CN, CS, CO, and n_{H_2}, appear to fit well the predictions of ion-molecule processes for forming and destroying interstellar molecules. The small ratios of CN to CH_3CN and HC_3N observed in a few sources might also be consistent with these processes. However, predictions of all of these relative abundances on the basis of catalytic reactions on grain surfaces are very different from what is observed. (auth)

18137 OH ZEEMAN OBSERVATIONS OF INTERSTELLAR DUST CLOUDS. Crutcher, R.M.; Evans, N.J. II (Owens Valley Radio Observatory, California Institute of Technology); Troland, T.; Heiles, C. Astrophys. J. 198: No. 1, 91-93 (15 May 1975).

We have attempted to measure Zeeman splitting of OH emission lines in two dust clouds. The upper limits on the Zeeman splitting indicate that the large-scale magnetic fields are less than 50 microgauss, a value significantly less than that expected if the magnetic field is frozen in during collapse. (auth)

18138 EMPIRICAL RELATION BETWEEN INTERSTELLAR X—RAY ABSORPTION AND OPTICAL EXTINCTION. Gorenstein, P. (Center for Astrophysics, Harvard College Observatory). Astrophys. J. 198: No. 1, 95-101 (15 May 1975).

An empirical relation between interstellar X-ray absorption and optical extinction is derived from the correlation of measurements made on objects of large intrinsic diameter. The result is $A_v=4.5\times10^{-22}$ N_H mag, with the principal error being largely systematic in origin, where N_H represents the column density of interstellar matter in the Brown and Gould model for the X-ray absorption coefficient. Applying this ratio to optically identified compact sources, it is concluded that sources in binary systems showing pronounced X-ray occultations have an intrinsic absorption equivalent to $\sim10^{22}$ atoms cm^{-2} of interstellar matter and that there are a few compact sources where the absorption seems to be primarily interstellar in origin. The interstellar absorption expected in Cyg X−1 from the extinction of its optical counterpart is much greater than that suggested by X-ray spectra, which may be due to a soft X-ray component greater than that predicted by the power law fitted to higher energy data. A reinterpretation of published spectral parameters of Cyg X−1 in its posttransition phase suggests that the soft component shifted downward in energy during the transition. The value of A_v/N_H determined from the X-ray measurements is compatible with the Lα results from 0A0 2. It is in accord with an interstellar dust-to-mass ratio of $\sim10^{-2}$. (auth)

18139 X—RAY ABSORPTION, INTERSTELLAR REDDENING, AND ELEMENTAL ABUNDANCES IN THE INTERSTELLAR MEDIUM. Ryter, C.; Cesarsky, C.J. (Centre d'Etudes Nucléaires de Saclay, Gif-sur-Yvette, France); Audouze, J. Astrophys. J. 198: No. 1, 103-109 (15 May 1975).

X-ray absorption and interstellar reddening along the line of sight to five supernova remnants are shown to yield the relationship $N_x/E_{B-V} = (6.8 \pm 1.6) \times 10^{21}$ equivalent H atoms cm^{-2} mag^{-1}. It is also shown that within 1 to ~5 kpc of the Sun, the "universal" abundances hold in the interstellar medium. The quoted value of the ratio N_x/E_{B-V} may also apply to the galactic center X-ray source; N_x and E_{B-V} individually are high, probably due to the presence of a large column of molecular hydrogen and/or an abundance gradient of metals (mainly C, N, O) in the Galaxy. (auth)

18140 NUCLEOCHRONOLOGY AND CHEMICAL EVOLUTION. Tinsley, B.M. (The University of Texas at Dallas and Austin). Astrophys. J. 198: No. 1, 145-150 (15 May 1975).

Considerations of chemical evolution have been used to generalize Schramm and Wasserburg's formalism for deriving a mean age of the elements in the Galaxy at the time (T) when the solar system formed. Comparison of the equations of nucleochronology with those of chemical evolution reveals that the earlier result is restricted to models in which the stellar birthrate varies linearly with the mass of gas in the system, and moreover to those in which the ratio of birthrate to gas mass defines a time-constant much greater than T. Relaxing the latter assumption, in particular (which seems necessary in the light of independent evidence), considerably increases the model-dependence of any determination of T from nucleochronometers. It is found that Schramm and Wasserburg's quantity $\Delta^{max} - \Delta$ (which can in principle be evaluated from abundances and nuclear data on the radioactive elements) does not necessarily lie between T/2 and T, as it does in the restricted set of models; instead, it may lie anywhere between 0 and T, depending critically on the nature of the evolutionary model. In particular, if inflows of metal-poor gas have significantly affected chemical evolution in the solar neighborhood, T could be considerably greater than $\Delta^{max} - \Delta$. This quantity is shown to be equal to the mean age of stable elements in the gas at time T. It is concluded that the nucleochronometers provide a model-independent *lower* limit to the time T, but that derivation of a more precise age of the Galaxy from radioactive time scales will require detailed understanding of its chemical evolution. (auth)

18141 OBSERVATIONS OF CARBON MONOXIDE EMISSION IN NGC 5367. Van Till, H.; Loren, R.; Davis, J. (Electrical Engineering Research Laboratory and Department of Astronomy, The University of Texas at Austin). Astrophys. J. 198: No. 1, 235-239 (15 May 1975).

Observations of the $J=1-0$ transitions of $^{12}C^{16}O$, $^{12}C^{16}O$, and $^{12}C^{18}O$ in NGC 5367 are reported. The CO line intensity contours lead us to conclude that the kinetic temperature peaks at the positions of two stars embedded in this molecular cloud, indicating that the gas is being heated by these stars. Photometric measurements on these stars suggest that they are of spectral type B. From the CO line intensities we estimate the mass of the molecular cloud to be $M_{cloud} \simeq 30\, M_\odot$. Assuming that these two embedded stars recently formed in this cloud, NGC 5367 is then an example of a relatively low mass cloud in which stellar formation may take place. Infrared and optical obeservations of these stars are suggested to test this hypothesis. (auth)

18142 INTEGRATED NEUTRAL HYDROGEN PROPERTIES OF NEARBY GALAXIES. Dean, J. F.; Davies, R. D. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 503-518(Mar 1975).

The H I emission from 17 nearby spiral and irregular galaxies has been studied with the MK II radio telescope (beamwidth 31′ × 33′) to provide integrated H I flux densities to an accuracy of 10 percent or better. Observations were made at a grid of points extending to the limits of each galaxy. These were used to derive the integrated spectrum, the extent and position angle of the line of isovelocity centroids and the systemic velocity for each galaxy. An indicative total mass, M_T, was estimated directly from the H I observations which agreed well with the value derived by other observers from rotation curves. This provides a simple H I technique for measuring M_T for any spiral or irregular galaxy. These new results gave values of M_H/L, M_H/M_T and M_T/L which showed less scatter within each morphological type as compared with previous investigations. (auth)

18143 ARE VERY LARGE GRAVITATIONAL REDSHIFTS POSSIBLE. Bonnor, W. B.; Wickramasuriya, S. B. P. (Queen Elizabeth Coll., London). Mon. Not. R. Astron. Soc.; 170: No. 3, 643-649(Mar 1975).

Solutions of the Einstein-Maxwell equations exist for charged dust in equilibrium under its own gravitational attraction and electrical repulsion. These are used to construct solutions for a sphere and a spheroid. In both cases arbitrarily large gravitational redshifts are possible, but as the spheroid shrinks to a disc, the redshift remains finite. One of the solutions shows clearly how a horizon filters out non-spherically symmetric fields. (auth)

18144 INTERSTELLAR FORMALDEHYDE PRODUCTION. Millar, T. J.; Williams, D. A. (Univ. of Manchester, Eng.). Mon. Not. R. Astron. Soc.; 170: No. 3, 51-55(Mar 1975).

Several mechanisms for forming interstellar formaldehyde are reviewed. Three new mechanisms involving neutral species are suggested. Calculations show that mechanisms of this type may explain observations of formaldehyde in dense clouds, but not in the less dense and more typical regions. (auth)

18145 OPTICAL VARIATION OF 3C371. Ourassine, L. (Alger Astronomical Observatory, Bouzareah, Algeria). Nature (London).; 254: No. 5496, 125(13 Mar 1975).

From observations of the nucleus of 3C 446, a hypothesis was advanced involving a small continuous source of constant luminosity that may be temporarily obscured by absorbing clouds. Such a hypothesis is here supported by observations of the nucleus of the N-galaxy 3C 371 that show variations of its luminosity during a time of 40 min. (UK)

18146 DERIVATION OF γ-RAY EMISSIVITY IN THE GALAXY FROM SATELLITE DATA. Strong, A. W. (Univ. of Durham, Eng.). J. Phys., A (London); 8: No. 4, 617-623(Apr 1975).

A method of deriving the γ-ray emissivity in the Galaxy by unfolding the longitudinal distribution of γ-ray intensity is proposed, and applied to the available data from the SAS-II and OSO-III instruments. The uncertainties in the analysis resulting from statistical errors in the data are estimated. A broad enhancement of emission 3 to 8 kpc from the Galactic centre is found. There is evidence for a drop in emissivity within 3 kpc of the centre, although the uncertainties in this region are very large. (auth)

18147 ASSESSMENT OF MODELS FOR THE γ-RAY FLUX FROM THE GALACTIC PLANE. Dodds, D. (Univ. of Durham, Eng.); Strong, A. W.; Wolfendale, A. W.; Wdowczyk, J. J. Phys., A (London); 8: No. 4, 624-635(Apr 1975).

An assessment is made of five models for the production of Galactic γ rays, all of which involve the interaction of cosmic ray protons with neutral hydrogen. Conflict with either the γ ray or radio data is found in four cases. The remaining model, in which the intensity of cosmic rays of energy of a few GeV is correlated with the matter distribution in the Galaxy, gives rough agreement with the experimental data at present available but it does not conform with the idea that cosmic rays should originate in young Galactic objects. A completely satisfactory model has yet to be found. (auth)

18148 HOT SPOTS IN THE CENTRAL REGIONS IN THE GALAXIES. I. NGC 3351. Nazarova, L. S. Izv. Krym. Astrofiz. Observ.; 52: 71-78(1974). (In Russian).

The galaxy NGC 3351 belongs to the small class of hot-spot nucleus galaxies. Charts of the intensity distribution in seven colors have been made of the results of the detail photometry. The red nucleus, $D \approx 3''$, situated between the hot spots has been found. The H_β luminosity $L(H_\beta) \approx 1.2 \cdot 10^{38}$ erg s^{-1} has been computed. The electron density n_e and electron temperature T_e have been determined by the results of spectrophotometric measurement: $n_e \approx 10^4$ cm^{-3}, $T_e \approx 7 \cdot 10^3$ °K. The possibility of the representation of the UV-excess by the radiation emitted by hot stars of the hot spots is discussed. (7 figs, 2 tables, 13 refs) (auth)

18149 MULTICOLOR PHOTOMETRY OF FOUR COMPACT MARKARIAN GALAXIES. Metik, L. P.; Pronik, I. I. Izv. Krym. Astrofiz. Observ.; 52: 65-70(1974). (In Russian).

Multicolour photometry (λ_{eff} 3600, 3730, 4400, 5090, 5280, 6090, 6600 and 7400 ÅÅ) of Markarian's galaxies 34, 42, 69 and 205 has been carried out. Galaxies Mr 69 and Mr 205 are compact and symmetric; galaxies Mr 34, Mr 42 and Mr 69 have structure details. All the galaxies investigated have colour characteristics similar to that of the central parts of Seyfert galaxies and synchrotron emission, while the halo of Mr 42 and Mr 34 resemble the central parts of normal galaxies. The nuclei of Mr 42, Mr 69 and Mr 205 galaxies are suspected of continuous emission variability. (2 tables, 5 figs, 30 refs) (auth)

18150 LUMINOSITY FUNCTION AND SPACE DENSITY OF GALAXIES WITH AN ULTRAVIOLET CONTINUUM. Arakelyan, M. A. (Byurakan Astrophysical Observatory, Erevan). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 432-435(1975).

Translated from Astron. Zh.; 51: No. 4, 730-735(1974).

A luminosity function for galaxies with an ultraviolet continuum is derived from the survey of Markaryan and Lipovetskii. On the average, the number density of such objects with absolute photographic magnitudes between −21.5 m and −16.5 m is 0.07 of the total number density of field galaxies in the same magnitude range. The proportion is greatest (0.11) for galaxies of the highest luminosity. Objects with spectra typical of Seyfert-galaxy nuclei and with M_{pg} between −21.5 m and −17.5 m have a number density

0.08 that of the UV galaxies and 0.005 that of all field galaxies in the same magnitude range. The number density of Seyfert-type objects might possibly increase toward lower luminosities. Dwarf UV galaxies are noteworthy for their high number density of 0.02 galaxy/Mpc^3 in the range $M_{pg} = -14.5$ to -12.5. (auth)

18151 DISTRIBUTION AND KINEMATICS OF NEUTRAL HYDROGEN IN THE SPIRAL GALAXY M81. Rots, A. H. Groningen, Netherlands; Groningen Univ. (1974). 69p.

Thesis.

This investigation presents neutral hydrogen observations of M81 at a linear resolution of 400 pc. Until now such data were only available for M31 (Emerson, 1973) and M33 (Wright et al., 1972; Warner et al., 1973). Of special importance is the information on the spiral structure of the neutral hydrogen gas, since M81 combines a clear spiral pattern with a favorable inclination, as opposed to both M31 and M33, as well as to our own Galaxy. Notwithstanding the uncertainties, the rotation curve obtained from the present data may be considered relatively well known. This curve and the detailed photoelectric study by Brandt et al. (1972) allow a fruitful comparison of mass and light distributions to be made. The detailed information on both kinematics and spiral structure renders interesting possibilities in connection with density-wave theory. Possible effects related to the presence of M82 confuse several aspects of this investigation. Hence, for future projects involving a study of mass distributions we would suggest that galaxies without (massive) companions or apparent asymmetrics be preferred. Finally observations of the kind made by Brandt et al. (1972) have proven to be very important. It would be most useful if such surveys could be extended to fainter surface brightnesses (where a trade-off with resolution would certainly be acceptable) and to longer wavelengths. (NL)

18152 INTERACTION OF METAGALACTIC X-UV RADIATION WITH GALACTIC HYDROGEN. Hill, J. K. (California Univ., Berkeley (USA). Dept. of Astronomy). Astron. Astrophys.; 34: No. 3, 431-436(Sep 1974).

Calculations show that the existence of a metagalactic x-uv flux of the intensity required to explain the high latitude soft x-ray observations, plus a reasonable extrapolation toward lower energies, is consistent with the existence of neutral hydrogen in galaxies. Shielding by H II slabs can be effective both in the solar neighborhood and in the peripheries of galaxies out to a radius of 30 to 40 kpc. At earlier cosmological epochs shielding is less efficient. The soft x-ray spectrum as observed by Yentis et al. is difficult to reconcile with a purely extragalactic origin for the flux. A local source of ionization also may be necessary to explain the pulsar dispersion data. (auth)

18153 REDSHIFTS OF PARENT GALAXIES OF SUPERNOVAE. Research Note. Barbon, R.; Capaccioli, M. (Consiglio Nazionale delle Ricerche, Asiago (Italy). Observatorio Astrofisico). Astron. Astrophys.; 35: No. 1, 151-152(1974).

Redshifts for nine parent galaxies of supernovae are presented. (auth)

18154 EMPIRICAL EVIDENCE FOR GALAXY EVOLUTION. Crane, P. (Joseph Henry Laboratories, Physics Department, Princeton University). Astrophys. J. Lett. 198: No. 1, L9-L12 (15 May 1975).

An analysis of the spectral energy distributions of distant galaxies suggests that galaxy evolution has been detected as a redshift-dependent change in the rest-frame spectra. The measured rate of color evolution agrees with previous limits, and is in qualitative agreement with synthesized galaxy models. (auth)

18155 RADIO VARIATIONS IN A NORMAL GALAXY. Sramek, R.A. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. Lett. 198: No. 1, L13-L15 (15 May 1975).

The radio radiation from M89 NGC 4552) was found to vary at centimeter wavelengths on a time scale of several years. These variations are consistent with an expanding, self-absorbing synchroton source, and are very similar to the radio variation seen in quasars. The velocity of the expanding cloud must be $v \sim 0.005c$; this low velocity is probably due to confinement of the cloud by interstellar matter. (auth)

Cosmology

Refer also to abstract 18143.

18156 (CONF-720133-2) IV BRAZILIAN SYMPOSIUM ON THEORETICAL PHYSICS. Volume VIII. Beyond the End of Time. Wheeler, J. A. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). 1972. 41p. Dep. NTIS (US Sales Only) $5.25.

From 4th symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

The treatment includes gravitational collapse as the greatest crisis in physics of all time, assessment of the theory that predicts collapse, vacuum fluctuation: their prevalence and final dominance, not geometry but pregeometry as the magic building material, pregeometry as the calculus of propositions, and the black box: the reprocessing of the universe. (JFP)

18157 CRITICAL REVIEW OF THE ARTICLES "POSSIBLE EXPLANATION OF COSMOLOGICAL RED SHIFT" AND "CLARIFICATION OF TWO POINTS" BY CHANG TS'AO. Pien, M. Wu-li; 3: No. 5, 319(18 Oct 1974). (In Chinese).

The two papers by Chang Ts'ao to explain cosmological red shift are criticized for contradicting his basic hypothesis of photon frequency attenuation. It is pointed out that the observation of red shift by a spectrometer requires that the wave form be monochromatic. However, this does not agree with the solution of the wave equation proposed by Chang Ts'ao which assumes an arbitrary waveform. (JPRS)

18158 POSSIBLE EXPLANATION OF THE COSMOLOGICAL RED SHIFT. Chang, T. Wu-li; 3: No. 5, 315-317(18 Oct 1974). (In Chinese).

The explanation of the phenomenon of cosmological red shift is closely related to the understanding of the origin of the universe. On the basis of the properties of light propagation in space, the author proposed an extension to the electromagnetic wave equation (Maxwell's equation) which is of the form $\nabla^2 E - [(1/c)(\partial/\partial\tau) + \mu]^2 E = 0$ and $\nabla^2 B - [(1/c)(\partial/\partial\tau) + \mu]^2 B = 0$ where μ is a parameter related to the rest mass of photon. The proposed theory provides a possible explanation of cosmological red shift which is in contradiction to the "expanding universe" theory. In addition, the theory also provides an estimate of the theoretical value of the rest mass of photon, $m_0 = 1.4 \times 10^{-66}$ gm, which is consistent with the upper bound of current experiment values. (JPRS)

18159 COMMENT ON THE ARTICLE "POSSIBLE EXPLANATION OF COSMOLOGICAL RED SHIFT". Fang, L. C. Wu-li; 3: No. 5, 318(18 Oct 1974). (In Chinese).

The author points out a fundamental error in the theory proposed by Chang T'sao to explain the phenomenon of cosmological red shift. By solving the extended Maxwell equation, the author proved that the frequency of the transmitted light source remains the same at any point in space, which is in contradiction to the hypothesis that a shift in frequency is present. (JPRS)

18160 CLARIFICATION OF TWO POINTS IN THE ARTICLE "POSSIBLE EXPLANATION OF COSMOLOGICAL RED SHIFT". Chang, T. Wu-li; 3: No. 5, 318-319(18 Oct 1974). (In Chinese).

In reply to a number of criticisms on the article "Possible Explanation of Cosmological Red Shift," the author attempts to clarify some apparent contradictions between his theory and the theory of relativity and quantum mechanics. Specifically, the following two points are addressed: (1) the validity of using statistical interpretation of wave function to explain the phenomenon of frequency attenuation is questioned, (2) the accuracy and range of application of Lorentz transformation are also questioned; the apparent disagreement between his theory and Lorentz transformation is explained by citing the example of Ohm's law which also violates the Lorentz transformations. (JPRS)

18161 GRAVITATIONAL WAVES FROM AN EARTHQUAKE. Vorob'ev, A. A. (Tomsk Polytechnical Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 6, 41-46(1974). (In Russian).

Rapidly intermixing mass radiates part of its energy as gravitational waves. It is possible to consider hurricanes and earthquakes as earth sources of gravitational waves during quadrupole radiation. These phenomena have the necessary parameters for generation of gravitational waves: a high value of the quadrupole m/r^2 and energy and mass being moved with great speed. Evaluations showed the possibility of observing gravitons from strong seismic centers. Local changes of the earth's gravistatic field and the appearance of gravidynamic fields during earthquakes could produce variations in the trajectory of the moon and of artificial satellites. The mathematical theory of trajectories, containing the graviton value, makes it possible to determine gravitons from data of trajectory measurements. (tr-auth)

18162 GRAVITATIONAL COLLAPSE AND LIGHT VELOCITY IN GRAVITATIONAL FIELDS. Treder, H. J. (Central Inst. for Astrophysics, Potsdam, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 325-334(Nov 1974). (In German).

An elementary criterion of the stability of a matter sphere against gravitational collapse is given by the circular velocity condition of POINCARÉ. (JFP)

18163 KINEMATIC EFFECT IN THE CLASSICAL DOMAINS AND THE REDSHIFT PHENOMENA OF EXTRAGALACTIC OBJECTS. Look, K. H.; Tsou, C. L.; Kuo, H. Y. Wu Li Hsueh Pao; 23: 225-238(Jul 1974). (In Chinese).

A space-time model with the classical domain D-lambda (1,4) is established based on the principle of relativity and the local constancy of the speed of light. The kinematic effect is discussed, and the frequency shift of the spectral line is calculated. With the assumption of uniform distribution, the results are compared with observational data on the quasar N-Z relation. The present results suggest that the large redshift in extragalactic objects is perhaps not caused mainly by the Doppler effect, but to a large extent is a distance effect. (IAA)

18164 COSMOLOGICAL MODELS AND NON-DENUMERABLE SINGULARITIES. Schlegel, R. (Michigan State Univ., East Lansing). Int. J. Theor. Phys.; 12: No. 3, 217-223(Feb 1975).

A review of the standard cosmological models shows that the positive cosmological constant gives rise to an exponential increase in spatial extension. Such an increase is contradictory if extended over infinite future time, since even in an infinite universe there can only be a denumerable infinity of finite spatial units. The argument against exponential expansion is among the processes forbidden by the steady-state postulate of MacMillan (Astrophys. J.; 48: 35 (1918) and Science (New York); 62: 63, 96, 121 (1925)). (auth)

18165 GRAVITATIONAL THEORIES OF POINCARE AND MILNE AND THE NON-RIEMANNIAN KINEMATIC MODELS OF THE UNIVERSE. Roxburgh, I. W.; Tavakol, R. (Queen Mary Coll., London). Mon. Not. R. Astron. Soc.; 170: No. 3, 599-610 (Mar 1975).

Milne's general kinematic discussion on cosmological models is reviewed, revised and extended and it is shown that Riemannian Geometry is insufficient for describing the general class of Milne's theories and that these theories if they are to be geometrized need the more general framework of Finsler spaces. Poincare's early relativistic gravitational theory is then reviewed and applied to the one-body and cosmological problems. It is shown that this theory is not Riemannian geometrizable but is Finsler geometrizable. The cosmological solution is explicitly evaluated and shown to be an example of Milne's general kinematic models. (auth)

18166 GRAVITATIONAL STABILITY OF SPHERICAL SYSTEM. Chandra, S. K. (Krishna Chandra Coll., Hetampur, India); Bondyopadhaya, R. Indain J. Phys.; 48: No. 9, 779-786(Sep 1974).

Using the collisionless Boltzmann equation in spherical coordinates, the perturbation method of Lindstedt has been applied to obtain the dispersion relations. Assuming wave solutions in velocity dependent circular form, a necessary criterion for gravitational stability has been derived. It is found that for such stability the initial gravitational force per unit mass element must be much less than $\omega/\alpha\dot{r}$, where ω, α and $\dot{r}$ represent the frequency of oscillation, the velocity dependent factor of perturbed parameter and radial velocity respectively. (auth)

18167 A CLASS OF INHOMOGENEOUS COSMOLOGICAL MODELS. Szekeres, P. (Adelaide Univ. (Australia). Dept. of Mathematical Physics). Commun. Math. Phys.; 41: No. 1, 55-64(Mar 1975).

All solutions of Einstein's field equations representing irrotational dust and possessing a definite metric are found. The new metrics generalize the earlier Bondi-Tolman, Eardley-Liang-Sachs, and Kantowski-Sachs cosmological models. (auth)

18168 MATTER-ANTIMATTER SEPARATION: THE TYPICAL SIZE OF THE EMULSION. Aly, J. J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Electronique Physique). Astron. Astrophys.; 35: No. 2, 311-313(Oct 1974).

An estimate is given of the characteristic scale of the separation of matter and antimatter in the first stage of the symmetric cosmology proposed by Omnes. It is found that this scale is determined by a hydrodynamical process due to the existence of a surface tension, rather than by a diffusion process. Its value at the end of the separation period is of the order of 7×10^{-4} cm. (auth)

Planetary Phenomena

Refer also to abstracts 17947, 18023, 18081, 18101, 18107, 18118, 18131, 18191, 18211, and 18256.

18169 (AD/A-002331) USE OF GODHAVN H-COMPONENT AS AN INDICATOR OF THE INTERPLANETARY SECTOR POLARITY. Svalgaard, L. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Oct 1974. 27p. (SU-IPR-596). NTIS $3.75.

An objective method of inferring the polarity of the interplanetary magnetic field using the H-component at Godhavn is presented. The objectively inferred polarities are compared with a subjective index inferred earlier. It is concluded that no significant difference exists between the two methods. The inferred polarities derived from Godhavn H are biased by the (S_q^D) signature in the sense that during summer, prolonged intervals of geomagnetic calm will result in inferred away polarity regardless of the actual secor polarity. This bias does not significantly alter the large-scale structure of the inferred sector structure. (GRA)

18170 (JPRS-63322) SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE. No. 335. 30 Oct 1974. Translation of Unidentified Russian Monograph. 51p. NTIS $4.25.

The report contains translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of soviet space spectaculars are included. (GRA)

18171 (LA-UR-75-358) GEOCHEMICAL MAPPING OF THE MOON BY ORBITAL GAMMA-RAY SPECTROSCOPY. Reedy, R. C. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-Eng-36. 7p. (CONF-750303-37). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Chemical compositions of the surfaces of the moon and certain planetary bodies can be determined by orbital gamma-ray spectroscopy. The major sources of gamma-ray lines (and of radionuclides) in the moon are the decay of the primordial radioelements (U, Th, and ^{40}K) and nuclear reactions induced by the bombardment of the moon by cosmic-ray particles. The major cosmogenic gamma-ray lines are produced by neutron nonelastic scattering and neutron capture reactions. The fluxes of gamma-ray lines expected from the moon for each major source have been calculated. Gamma-rays from the moon were measured by gamma-ray spectrometers during the Apollo 15 and 16 missions. The preliminary analysis of the data show that O and Si vary little over the moon's surface, that Mg, Fe, and Ti have higher concentrations in the maria than in the lunar highlands, and that the radioelements are significantly more abundant in and near the western nearside maria than in the rest of the moon. (auth)

18172 POLARIZATION STRUCTURE OF JUPITER'S DECAMETRE RADIO BURSTS. Riihimaa, J. J. (Oulu Univ., Finland). Nature (London).; 255: No. 5505, 210-211(15 May 1975).

It is stated that the high resolution dynamic spectra of Jupiter's decametre radio emission show structures consisting of repeated tilted ridges. The frequency-time slope of these diagonal patterns, also referred to as "modulation lanes", varies from 50 to 300 kHz, and may be either positive or negative. A study is here reported of polarization reversals in the spectra of modulation lanes. A new instrument was built for the purpose, the antenna of which is a steerable system of two cross log-periodic units in parallel. Details are given of the experimental equipment. The display unit consists of a red and green array of 96 light-emitting diodes, the sense of polarization being indicated by the color of the spectrum, and the recording made on a color reversal film. The observations were made in August to September 1974 at Kiiminki, Finland. It was found that polarization reversals do not generally occur in the spectra of modulation lanes, although there were a few cases in which it did appear. (UK)

18173 MAGNETIC FIELD OF MERCURY CONFIRMED. Ness, N. F.; Behannon, K. W.; Lepping, R. P.; Whang, Y. C. (National Aeronautics and Space Administration, Greenbelt, MD). Nature (London).; 255: No. 5505, 204-205(15 May 1975).

It is stated that an earlier tentative conclusion that Mercury has a small intrinsic magnetic field was confirmed at the third encounter of the planet by the US spacecraft Mariner 10 on 16 March 1975. The spacecraft carried the NASA Goddard Space Flight Center magnetic field experiment. The origin of this field is uncertain, but it is tentatively concluded that the observations reported require the existence of an active dynamo mechanism in the large Fe-Ni core. (UK)

18174 PRELIMINARY INTERPRETATION OF PLASMA ELECTRON OBSERVATIONS AT THE THIRD ENCOUNTER OF MARINER 10 WITH MERCURY. Hartle, R. E.; Ogilvie, K. W.; Scudder, J. D.; Bridge, H. S.; Siscoe, G. L.; Lazarus, A. J.; Vasyliunas, V. M.; Yeates, C. M. (National Aeronautics and Space Administration, Greenbelt, MD). Nature (London).; 255: No. 5505, 206-208(15 May 1975).

It is stated that observations of electrons with energies between 13.4 and 690 eV made at the first encounter of Mariner 10 with Mercury unexpectedly showed the presence of a strong bow shock wave, enclosing a magnetosheath and magnetosphere with boundaries the positions of which could be explained by assuming the planet possesses an appreciable magnetic moment, in agreement with magnetometer observations made from the spacecraft.

Inside these boundaries distributions of magnetospheric particles were observed. A second encounter occurred in September 1974, but did not permit observations inside the planet's bow shock. The third encounter occurred in March 1975, at which time the spacecraft passed within 330 km of the planet's surface. The primary purpose of this last encounter was to determine whether the magnetic moment of the planet was intrinsic and to enable further experimental set-up; the electron spectrometer employed obtained an electron spectrum every 6 sec., from which the density, temperature, etc., could be obtained. Results are discussed, and strongly support the idea that Mercury's magnetic field is intrinsic, rather than induced, and also that Mercury's magnetic field is remarkably similar to that of the Earth. (UK)

18175 ELEMENTAL FRACTIONATIONS AMONG ENSTATITE CHONDRITES. Baedecker, P. A.; Wasson, J. T. (California Univ., Los Angeles). Geochim. Cosmochim. Acta; 39: No. 5, 753-765(May 1975).

Neutron activation data on 14 elements in eight enstatite-chondrite falls are reported. These and literature data on an additional 28 elements show that intragroup elemental fractionations generally fall into one of three basic patterns: (1) siderophilic- and chalcophilic-element abundances are about 1.5 times greater in E4-5 than in E6 chondrites; (2) nonvolatile lithophile element abundances in E4-5 chondrites are generally about 1.0 to 1.2 times those in E6 chondrites; and (3) highly volatile elements are higher in E4-5 chondrites than in E6 chondrites by factors of 6 to 50. In addition, abundances (relative to Si) of most refractory and volatile elements are lower (by factors of 0.5 to 0.9) in E4 chondrites than in C1 chondrites. Because of the compositional hiatus often observed between E4-5 and E6 chondrites, there exists the distinct possibility that they are separate groups which were stored in different parent bodies. However, because of their close similarity in oxidation state, it seems likely that they originated at the same nebular location, far removed from the formation locations of the other, much more oxidized groups of chondrites. The E-group fractionation patterns are explained in terms of four fractionation processes. The low degree of oxidation of enstatite chondrite materials is best understood in terms of a fractionated nebula. At a pressure of 10^{-4} atm the Si content of E4 metal can be produced at 1350°K if the H_2O/H_2 ratio is 5 times lower than that in unfractionated solar-system material. A nebula-wide fractionation process involving radial transport of refractories and H_2O is indicated, and a suitable model in which the nebula-wide mixing of the gas phase continues during condensation is proposed. (auth)

18176 FRACTIONATION IN THE SOLAR NEBULA: CONDENSATION OF YTTRIUM AND THE RARE EARTH ELEMENTS. Boynton, W. V. (Oregon State Univ., Corvallis). Geochim. Cosmochim. Acta; 39: No. 5, 569-584(May 1975).

The condensation of Y and the rare earth elements (REE) from the solar nebula may be controlled by thermodynamic equilibrium between gas and condensed solids. Highly fractionated REE patterns may result if condensates are removed from the gas before condensation is complete. It is found that the fractionation is not a smooth function of REE ionic radius but varies in an extremely irregular pattern. Both Yb and Eu are predicted to be extremely depleted in the early condensate without the requirement of condensation in the divalent state. The model is discussed with respect to a highly fractionated pattern observed by Tanaka and Masuda (Icarus; 19: 523 (1973)), in a pink Ca–Al-rich inclusion from the Allende meteorite and can account for the abundances of each REE determined. According to the model this inclusion represents a condensate from a previously fractionated gas rather than from a gas of solar composition. Before the condensation of this inclusion, an earlier condensate was formed and was removed from equilibrium with the gas. (auth)

18177 CONTRIBUTION TO THE STABLE CARBON ISOTOPE GEOCHEMISTRY OF IRON METEORITES. Deines, P.; Wickman, F. E. (Pennsylvania State Univ., University Park). Geochim. Cosmochim. Acta; 39: No. 5, 547-557(May 1975).

For most iron meteorites studied, the carbon isotopic composition of nodular graphite falls in the range −4.8 to −8.2‰ vs PDB and shows a mode between −5 and −6‰. Fourteen cohenite analyses from the Magura meteorite fall between −18.1 and −19.2‰ with a pronounced clustering around −18.5‰. Carbon of a taenite separate from the same meteorite has an isotopic composition of −18.8‰; compositions between −19.7 and −22.1‰ were found for taenite carbon in five other octahedrites. It is suggested that the ^{12}C enrichment in cohenite and taenite relative to the nodular graphite is a general phenomenon in iron meteorites, and that the study of ^{13}C abundances in iron meteorites may aid in the elucidation of their history. To this end an experimental study of carbon isotope fractionations in the system Fe–Ni–C is essential. The ^{13}C content of carbon from several silicate inclusions in the Four Corners and "El Taco" (Campo del Cielo) meteorites is generally similar to the nodular graphite; the ^{12}C enrichment (−13‰) in one specimen may be interpreted in terms of a mixing model involving an original inclusion carbon and carbon exsolved from the taenite upon cooling. (auth)

18178 POSSIBLE MECHANISM OF ION ACCELERATION IN TYPE I COMET TAILS. Chernikov, A. A. (Inst. of Cosmic Research, Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 505-508(1975).

Translated from Astron. Zh.; 51: No. 4, 852-858(1974).

A mechanism of momentum transfer from the solar wind to cometary plasma is examined. It is shown that for interaction of the solar wind with Type I cometary tails various instabilities can occur in the plasma, whereas the ion-sound one possesses the largest growth rate. The plasma becomes turbulent because of development of this instability, which in turn leads to an increase of the momentum transfer rate from the solar wind protons to the cometary ions. Estimates obtained of cometary ion acceleration agree with observations. (auth)

18179 ROLE OF BALLISTIC EROSION AND SEDIMENTATION IN LUNAR STRATIGRAPHY. Oberbeck, V. R. (Ames Research Center, Moffett Field, CA). Rev. Geophys. Space Phys.; 13: No. 2, 337-362(May 1975).

Many of the lunar surface formations have been emplaced by impact craters. Two mechanisms have been proposed for transport of crater ejecta; both the base surge and ballistic transport mechanisms are reviewed in this paper. Formation of base surges associated with underwater and underground explosion craters and with volcanic events all require the presence of an atmosphere in the area where ejecta impacts. Because the moon contains no appreciable atmosphere, it is concluded that the base surge mechanism of separation and transport of fine-grained crater ejecta is not a viable lunar process. Studies of laboratory impact craters, high-explosion and nuclear craters, and lunar craters, and theoretical studies of formation of impact craters indicate that material is ejected from impact craters at low angles to the surface. Calculated ejecta positions at constant times after impact of the body that produced Copernicus crater are similar to shapes that are observed when laboratory craters are formed. Results are used to construct a model of emplacement of deposits of craters of all sizes. It is concluded that deposits of large craters contain local preexisting material as well as crater ejecta. The cratering model is used to synthesize many lunar observations. Model results, coupled with lunar observations, suggest that lunar smooth plains are in some places the erosional products of secondary craters of many highland craters and in some places they were emplaced by basins and consist of basin ejecta mixed with regional and local material. The small low-albedo smooth pondlike deposits that surround many lunar craters may be impact melts. If they are and if they were emplaced from ballistic trajectories, then the angles of ejection must have been much higher than the angles of ejection of the other ejecta which may be explained if impact occurs in a layered target. This suggests that impact melts in crater deposits may result from stratigraphic layering within the area of the crater. (24 figures, 96 references) (auth)

18180 POSSIBLE ACCELERATION OF CHARGED PARTICLES THROUGH THE RECONNECTION OF MAGNETIC FIELD LINES IN INTERPLANETARY SPACE. Levy, E. H. (Franklin Inst., Swarthmore, PA); Ipavich, F. M.; Gloeckler, G. Geophys. Res. Lett.; 1: 145-148(Aug 1974).

Prominent intensity spikes in the flux of protons and alphas with less than 0.5 MeV per charge have been observed in the region several hours behind an interplanetary shock front. The small spatial scale of these events and the high anisotropy of the particle flux suggest local acceleration. The spectra of the particles, which are cut off at equal energy per charge, suggest acceleration through an electric field. The possibility that these events have their origin in active magnetic neutral sheets in the shocked solar wind is examined. (auth)

18181 SATURN'S RINGS: THE DETERMINATION OF THEIR BRIGHTNESS TEMPERATURE AND OPACITY AT CENTIMETER WAVELENGTHS. Cuzzi, J.N.; Dent, W.A. (Department of Physics and Astronomy, University of Massachusetts, Amherst). Astrophys. J. 198: No. 1, 223-227 (15 May 1975).

Interferometric observations of Saturn at 3.7 cm wavelengths are used to determine the brightness temperature of the B ring, $T_B = 15 \pm 3$ K, and the mean normal depth to extinction of the B ring, $\tau_0 = 0.8 \pm 0.1$. When these results are combined with model calculations of the brightness of the rings due to both thermal emission and diffuse multiple scattering of the radiation from the planet, the single scattering albedo of a typical ring particle at λ3.7 cm is found to be $\tilde{\omega}_0 = 0.999(+0.001, -0.01)$. (auth)

18182 INFLUENCE OF LONG-LIVED RADIOACTIVE ISOTOPES ON THE THERMAL HISTORY OF THE EARTH. Forni, L. Atti. Accad. Sci. Torino. I. Cl. Sci. Fis., Mat. Natur.; 108: No. 3-4, 341-351(1974). (In Italian).

The influence of radioactive isotopes on heat balance and on the temperature's evolution in the Earth's mantle is studied following meteoritic models for interior structure and uniform distribution of temperature at 1200°C for the primeval Earth. The main conclusions are: 1) The long-lived radioactive isotopes seem to be the chief protagonists in the thermal history of the Earth. As a matter of fact, the internal temperature at the boundary between the core and the mantle grows from 1700°K, when the model has no radioactive heat sources to 3500 to 4000°K verified in the model with radioactive heat sources. 2) With regard to the radioactive elements, the different composition of the meteoritic models examined doesn't cause substantial differences in the temperature curves, so that all the models studied can be considered equally representative from this point of view. 3) The migration of radioactive elements doesn't affect the thermal balance remarkably, even if it modifies temperature curves. (auth)

18183 CORRELATION OF GEOMAGNETIC DISTURBANCES AND SEISMIC ACTIVITY OF EARTH. Al'tgauzen, N. M. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 593-595(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 698-701(1974).

The results are presented of a correlation analysis of the energy of strong surface earthquakes and that of geomagnetic disturbances. A 3-year delay in the release of seismic energy with respect to variations in geomagnetic activity is established for the "slow variation" and a 2-year delay for the 11-year periodicity. (6 figures) (auth)

18184 44 NYSA: AN IRON-DEPLETED ASTEROID. Zellner, B. (Lunar and Planetary Laboratory, University of Arizona). Astrophys. J. Lett. 198: No. 1, L45-L47 (15 May 1975).

The minor planet 44 Nysa has a unique combination of photopolarimetric parameters, with the most nearly neutral *UBV* colors, the shallowest negative polarization branch, and by far the highest polarimetric albedo yet obtained for any asteroid. Its surface apparently consists of a low-opacity, iron-free silicate strongly suggestive of enstatite achondrites. (auth)

PHYSICS (ATMOSPHERIC)

18185 (JPRS-63623) SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE. No. 338. Translated from Various Journals. 41p. NTIS $3.75.

Research is outlined on gas dynamics of flare region heated by accelerated electrons; Nature of albedo of lunar surface; Double IR-spectrometer for measuring humidity fluctuations; Pressure fluctuations during suction of turbulent boundary layer; Detailed gravimetric survey using string gravimeter; Seismic waves and earthquakes in Kamchatka zone; Prognoz measurements of solar wind; Magnetic properties of lunar rocks characteristics of detectors of cosmic gamma radiation; leakage of charged particles from radiation belts; Temperature of subsurface layer on Mars; High-energy electrons of cosmic rays; Admixture ions in ionospheric F2 region; Method for determining altitude of upper cloud boundary; Laser sounding of the upper layers of the atmosphere. (GRA)

Auroral and Ionospheric Phenomena

Refer also to abstracts 17934, 18065, 18076, 18078, 18080, 18115, 18170, 18252, 18253, 18271, and 18383.

18186 (AD-774917) WAVE INTERACTION IN THE LOWER IONOSPHERE: A SURVEY. Waynick, A. H. (Office of Naval Research (USA). London Branch Office). 4 Dec 1973. 16p. (ONRL-R-30-73). NTIS $3.00.

A summarization of the reviews to date on the field of wave interaction in the lower ionosphere is attempted. This covers the study of the interaction process and the determination of electron density, N, and electron-neutral collisional frequency, nu, height distributions in D-region. The current status of the use of this technique in synoptic profile procurement and the role of this work in investigations on the physics and chemistry of this region are outlined. (auth)

18187 (AD-782921) DIFFERENTIAL PHASE VOLUME MODEL AND AMPLITUDE MEASUREMENTS OF PARTIAL REFLECTIONS. Scientific Report. Newman, D. B. Jr. (Pennsylvania State Univ., University Park (USA). Ionosphere Research Lab.). 21 Jun 1974. Contract N00014-67-A-0385-0014. 194p. (PSU-IRL-SCI-426). NTIS $12.75.

A theoretical model of the differential phase experiment is presented, which accounts for scattering from a volume of irregularities. The expected value of the phase difference angle between ordinary and extraordinary mode partially reflected radio waves is derived, and computer simulated data from several electron number density profiles are presented. The effect of the transmitter pulse length is clearly indicated and limitations of the theory in terms of probing frequency are discussed. An extensive effort was undertaken to investigate the nature of scattering of signals from the D-region. Numerous recordings of amplitude data were made, and the resulting data analysis shows that the amplitudes of partially reflected echoes obey a Rayleigh probability density function. This finding strongly supports the volume theory of this work. The study of amplitude data also shows that the D-region is generally quasi-static over a time period of 150 milliseconds during noon time and quiet ionospheric conditions. With this finding, it is suggested that for a successful differential phase experiment and an improved differential absorption experiment a set of ordinary and extraordinary mode transmitted pulses should be transmitted within this time period. (auth)

18188 (AD-782924) MACHINE REDUCTION OF IONOGRAMS: TESTING OF AND IMPROVEMENTS TO THE PROCESS. Scientific Report. Bennett, P. E. (Pennsylvania State Univ., University Park (USA). Ionosphere Research Lab.). 31 May 1974. Contract N00014-67-A-0385-0017. 79p. (PSU-IRL-SCI-427). NTIS $7.00.

The sources of error in a machine reduction program for ionogram data were evaluated. The major source of error was found to be the tracing of the returns. The magnitudes of the errors were found to be small in comparison with those expected in the input data. A pattern recognition technique was developed to aid in the computer identification of traces on the ionogram tracings. Test results indicated that significant increases in useable data could be gained by the use of this technique. Several programs for the calculation of electron density were tested. General accuracy, underlying ionization corrections, peak extrapolation and the times required for computation were tested. (GRA)

18189 (AD-785825) ANALYSIS TECHNIQUES FOR INCOHERENT-SCATTER DATA INTERPRETATION IN THE 100 TO 300 km REGION. Technical Report No. 3, January–December 1973. Wickwar, V. B. (Stanford Research Inst., Menlo Park, Calif. (USA)). Jan 1974. Contract DNA001-72-C-0076. 74p. (DNA-3335T). NTIS $4.25.

This report examines the factors involved in the derivation of temperature information from Chatanika radar data by means of a least-squares fitting of theoretical autocorrelation functions (ACF) to the measured ACFS. The combined influence of these factors and the range of possible interpretations is shown for models of the auroral and daytime ionospheres. Finally, an indication is given of what remains to be examined and done to fully implement the least-squares fitting procedure. (GRA)

18190 (AD-915474) RECENT EXPERIMENTS EXPLORING THE PROPERTIES OF F-REGION IRREGULARITIES THAT GIVE RISE TO SPREAD F AND SCINTILLATIONS. Research and Development Report, January–July 1973. Labahn, R. W. (Naval Electronics Lab. Center, San Diego, Calif. (USA)). Oct 1973. 21p. (NELC-TR-1896). NTIS $3.25.

The current state of knowledge of the F-region irregularity phenomenon is determined. In particular, the results of recent experiments are summarized: (1) two in-situ satellite probes that determine the magnitudes, locations, and extents of the irregularity regions; (2) ground-based VHF radar explorations that confirm the turbulent structure of the regions; and (3) long-term monitorings of geostationary satellite beacons which reveal gross drift properties and the dependence on solar activity. (GRA)

18191 (AD/A-000017) COMPILATION OF SOLAR PARTICLE AND INTERPLANETARY MEASUREMENTS ACQUIRED DURING THE CAMPAIGN FOR INTEGRATED OBSERVATIONS OF SOLAR FLARES (CINOF). Shea, M. A.; Smart, D. F. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 19 Jun 1974. 150p. (AFCRL-TR-74-0271; AFCRL-SR-177). NTIS $5.75.

The campaign for integrated observations of solar flares (CINOF) was a period of extensive solar flare studies conducted 5-29 June 1972. During this period two discrete solar particle injections occurred, in addition to which significant modulations to the low energy solar particle background flux were present. Fifteen individually authored papers presenting the x-ray, solar particle, and other related interplanetary and geophysical measurements obtained from 28 May–30 June 1972 are given. A final paper summarizes the particle measurements for the eleven particle enhancements identified during this period. (auth)

18192 (AD/A-000018) IONOSPHERIC TOTAL ELECTRON CONTENT DISTURBANCE ASSOCIATED WITH THE LAUNCH OF NASA'S SKYLAB. Mendillo, M.; Hawkins, G. S.; Klobuchar, J. A. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 29 Jul 1974. 40p. (AFCRL-TR-74-0342; AFCRL-ERP-483). NTIS $3.75.

By monitoring the amount of Faraday rotation a plane polarized satellite signal experiences in traversing the ionosphere, it is possible to measure the total number of electrons in a column of unit cross section through the earth's ionosphere. Ground-based total electron count observations and the skylab launch; electron loss mechanisms in the f-region; diffusion of the Saturn V S-II plume in the ionosphere; ionosonde observations; and estimates of photochemical and aeronomic processes capable of depleting the expanding plume are discussed. (GRA)

18193 (AD/A-000568) AURORAL EMISSION OF THE N_2^+ MEINEL BANDS. Cartwright, D. C.; Pendleton, W. R. Jr.; Weaver, L. D. (Aerospace Corp., El Segundo, Calif. (USA)). 18 Sep 1974. Contract F04701-74-C-0075. 23p. (SAMSO-TR-74-227). NTIS $3.25.

New cross sections for electron impact excitation and quenching of the N_2^+ Meinel bands have been combined with recently determined transition probabilities to yield altitude profiles of the Meinel bands relative to those for the N_2^+ first negative system. Quenching of the Meinel bands is found to be important for altitudes less than 120 km. The calculated intensity of the Meinel band system relative to that of the first negative system agrees reasonably well with the more recent auroral measurements. (auth)

18194 (AD/A-000926) IONOSPHERIC RESEARCH USING SATELLITES. The Total Electron Content of the Ionosphere over Legon for the Year 1972. Final Scientific Report, 1 January 1972–31 December 1973. Koster, J. R. (Ghana Univ., Legon.

Dept. of Physics). 26 Jun 1974. 94p. (AFCRL-TR-74-0414). NTIS $4.75.

Polarimeter measurements of the total Faraday rotation angle imposed by the ionosphere on the VHF signal radiated by ATS-3 have been used to determine the total columnar electron content of the ionosphere over Legon, Ghana, at ten minute intervals throughout the year 1972. The actual data are preceded by a brief discussion of the practical problem of determining the m value, correcting the polarimeter reading for satellite position, determining the polarimeter zero, and estimating the accuracy of the results. (GRA)

18195 (AD/A-001570) IVORY CORAL PROGRAM ON IONOSPHERIC MODIFICATION. Technical Summary, October 1970–December 1973. Vandelind, M. R. (Stanford Research Inst., Menlo Park, Calif. (USA)). Sep 1974. 149p. NTIS $5.75.

The Ivory Coral Program is an outgrowth of early ARPA over-the-horizon radar research. The primary objectives of the Ivory Coral program were to modify the ionosphere in a controllable manner, to determine the characteristics of the modified volume, and to develop and verify models of the modified volume. The results of the Ivory Coral program clearly demonstrate that the ionosphere can be modified and characterized when illuminated with reasonable RF power densities. Changes in the ionospheric electron density, electron temperature, and collision frequency have been observed and are reasonably well understood. Structuring of the modified volume has been observed using a variety of radio scattering and scintillation methods. (GRA)

18196 (AD/A-002311) IONOSPHERIC ANALYSIS AND IONOSPHERIC MODELING. Miller, D. C.; Gibbs, J. (Arcon Corp., Wakefield, Mass. (USA)). Jul 1974. Contract F19628-74-C-0070. 79p. (AFCRL-TR-74-0364). NTIS $4.75.

Investigations performed towards the development of improved models of the ionosphere are described. The study was directed at improving existing prediction models of ionospheric parameters. This led to the development of techniques to update, on a global basis, monthly median predictions of (F_0) F2 and M(3000)F2. A new electron density model is presented which allows the user to make a full three dimensional ionosphere for use in a variety of HF radio applications. Extensive tests are presented which explore the model's accuracy. Parts of a separate model for the polar region have been consolidated and incorporated in programs for the evaluation of HF performance criteria. (GRA)

18197 (AD/A-002966) SCIENTIFIC RESULTS OF THE FLIGHT OF THE AUTOMATIC IONOSPHERIC LABORATORY "Yantar-4". 27 Nov 1974. Translated by R. T. Grozier from pp 1-16 of Paper Presented at the International Astronautical Federation (24th) Baku, October 7–13, 1973. 17p. NTIS $3.25.

18198 (AD/A-003070) LONG DELAYED RADIO ECHOES. Sears, D. M. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Nov 1974. Contract N00014-67-A-0112. 245p. (SU-IPR-584). NTIS $7.50.

The experimental program involved transmitting a radio signal, and tape-recording the output of a receiver gang-tuned with the transmitter for the following 30 s interval. The tapes were later audited for possible long delayed echoes (LDE). Although none of the possible LDE received reproduces exactly the transmitted signal, many exhibit features that seem unlikely to have been generated except by an LDE mechanism. A mechanism for producing LDE was studied which involves signal propagation in an electron plasma wave mode at very low group velocity. A weak beam-plasma instability, due to the presence of electrons precipitating into the ionosphere, is postulated as a means of offsetting collisional and collisionless attenuation of the plasma wave. Local inhomogeneities in the ionosphere cause coupling from the transmitted transverse wave to the plasma wave, and from the plasma wave to a transverse wave which can propagate back to the earth. Coupling efficiencies are estimated. (GRA)

18199 (COM-74-50276-34) ABSORPTION DATA FOR THE IGY/IGC AND IQSY. Shapley, A. H.; Piggott, W. R.; Rawer, K. (World Data Center A for Solar-Terrestrial Physics, Boulder, Colo. (USA)). Jun 1974. 387p. (UAG-34; NOAA-74072248). National Climatic Center, Asheville, NC 28801, $2.00.

The Al absorption data from all known stations were collected for the periods of the IGY/IGC (1957–1959) and the IQSY (1964–1965), periods of sunspot maximum and sunspot minimum, respectively, and tabulated in a uniform manner. (GRA)

18200 NEGATIVE ION EFFECT ON THE ABSORPTION OF VLF AND ELF WAVES IN WHISTLER MODE. Agarwal, D. C. (Univ. of Allahabad, India). Indian J. Theor. Phys.; 22: No. 3, 81-84(Sep 1974).

The effects due to presence of negative ions on the absorption of vlf and elf waves in the whistler mode propagation at mid-latitudes are considered for normal days. It is found that negative ions cause an increase in the absorption of elf waves. (auth)

18201 CROSS-MODULATION OF ELECTROMAGNETIC WAVES IN PLASMA LIMITED VOLUMES. Gorovenko, A. P.; Fialko, E. I.; Bairachenko, I. V. (Kiev State Univ.). Astrometriya Astrofiz.; No. 26, 108-112(1975). (In Russian).

A possibility of using the non-linear effect of cross modulation to determine the meteor trails is considered. The disturbing effect of a strong pulse on the plasma parameters is estimated. It is shown that the technique used in the experiments on ionospheric cross-modulation can be a basis for studying heated non-linear effects in the meteor trails. (9 refs, 3 tables) (auth)

18202 DEVELOPMENTS IN IONOSPHERIC PHYSICS SINCE 1957. Bain, W. C.; Rishbeth, H. (Science Research Council, Slough, Eng.). Radio Electron. Eng.; 45: No. 1-2, 3-10(Jan 1975).

The year 1957 marked the beginning of the International Geophysical Year and the satellite era, and this review describes the most important developments in ionospheric science since then. The discoveries made by different techniques concerning the nature and formation of the D, E, and F layers and their various anomalies are considered and the relationship between the ionosphere and the region above it, the magnetosphere is briefly discussed. (auth)

18203 λA557.7 nm PULSATIONS WITHIN QUIET PRE-BREAKUP AURORAE AT L = 8.7. Thomas, I. L. (Univ. of Melbourne, Parkville, Australia). Aust. J. Phys.; 27: No. 6, 855-858(Dec 1974).

Pulsations in the [OI] λ557.7 nm emission, with a typical period of 10–20 s, were consistently observed within quiet pre-breakup auroral forms from Mawson, Antarctica (L = 8.7), during 1967. By relating these observations to the modal location of the auroral oval, an indication of the parent magnetospheric region is gained. From these results, and other reports, it is concluded that optical pulsations are a basic feature of the auroral display. The occurrence of an 'optical auroral pulsation pearl necklace' is reported. (auth)

18204 SOLAR-TERRESTRIAL RELATIONS AND SHORT-TERM IONOSPHERIC FORECASTING. Cook, F. E.; McCue, C. G. (Dept. of Science, Darlinghurst, Australia). Radio Electron. Eng.; 45: No. 1-2, 11-30(Jan 1975).

Since the ionosphere is produced by the quiet Sun and disturbed by the active Sun, short-term ionospheric forecasting is discussed in three stages: (1) forecasting the solar activity; (2) the relations between the solar activity and geophysical disturbances, particularly magnetic storms, daylight fadeouts and polar cap absorption; (3) the effects of these geophysical disturbances on the ionospere and on ionosperic radio communications. A short history of the subject is given, the international arrangements for collecting and rapidly exchanging the required solar and geophysical data are outlined, and short-term forecasting services at present operating are described briefly. (auth)

18205 DETERMINATION OF IONOSPHERIC VERTICAL PROFILES THROUGH GROUND MEASUREMENTS ON SATELLITE TRANSMISSION. Checcacci, P. F.; Lombardi, C.; Scheggi, A. M. (Istituto di Ricerca sulle Onde Elettromagnetiche, Florence). Alta Freq.; 43: 764-768(Oct 1974).

From congress on application of electronics to telecommunications, radiolocalization, and meteorology; Bologna, Italy (15 Jun 1974).

The spatial impulse response function of the ionosphere can be measured using beacon satellite signals. Such impulse response function carries information on the ionospheric vertical profile. A method is described which allows the determination of the parameters of simple ionospheric profiles starting from a measured impulse response function. A computer simulation is presented which shows the feasibility of the method. (auth)

18206 DIURNAL VARIATIONS OF ATOMIC HYDROGEN: OBSERVATIONS AND CALCULATIONS. Tinsley, B. A. (Univ. of Texas, Dallas); Hodges, R. R. Jr.; Strobel, D. F. J. Geophy. Res.; No. 4, 626-634(1 Feb 1975).

Theoretical calculations of the diurnal variation of atomic hydrogen in the thermosphere are presented that simultaneously evaluate the effects of thermosphere rotation, thermal escape, charge exchange with O^+ ions, charge exchange with hot H^+ ions, transport due to winds, and ballistic fluxes in a consistent manner. The first five effects cause a significant departure from the zero net ballistic flux conditions. A thermospheric wind with a peak velocity of 50 m s^{-1} at exobase altitude and a total charge exchange flux varying from 0 to 2 x 10^9 cm^{-2} s^{-1} are found to be consistent with the observations. (auth)

18207 INTENSITY VARIATION OF ELF HISS AND CHORUS DURING ISOLATED SUBSTORMS. Thorne, R. M.; Fiske, K. F.;

Church, S. R. (Univ. of California, Los Angeles). Geophys. Res. Lett.; 1: 193-196(Sep 1974).

Electromagnetic ELF emissions (100-1000 Hz) observed on the polar-orbiting OGO-6 satellite within three hours of the dawn-dusk meridian consistently exhibit a predictable response to isolated substorm activity. Near dawn, the emissions intensify during the substorm and then subside following the magnetic activity; the waves are most intense at L greater than 4, exhibit considerable structure and have been primarily identified as chorus. At dusk, the response is entirely different; the wave intensity falls to background levels during substorm activity but subsequently intensifies, usually reaching levels well in excess of that before the disturbance. The emissions near dusk extend to low L, are relatively featureless, and have been identified as plasmaspheric hiss. These features are interpreted in terms of changes in the drift orbits of outer-zone electrons which cyclotron resonate with ELF waves. (auth)

18208 FARLEY INSTABILITY IN THE POLAR CAP E REGION. Olesen, J. K.; Primdahl, F.; Spangslev, F. (Danish Meteorological Inst., Copenhagen). J. Geophy. Res.; 80: No. 4, 696-698(1 Feb 1975).

The slant E condition (SEC) on polar cap ionograms is shown to be a signature for the Farley instability in the polar cap E region. A correlation is found between the sign of the azimuthal component of the interplanetary magnetic field and the SEC occurrence in the cap, B/sub y/ greater than 0 (B/sub y/ less than 0) corresponding to peak SEC occurrence in the northern polar cap dawn (dusk) sector. (auth)

18209 GROUP TRAVEL TIME FOR PROTON WHISTLERS IN THE IONOSPHERE. Singh, S. N.; Tolpadi, S. K. (Banaras Hindu University, India). J. Geophy. Res.; 80: No. 4, 694-695 (1 Feb 1975).

A theoretical relation is derived for the group travel time of the proton whistlers to reach the satellite from their place of occurrence. The expression for the group travel time contains two terms. The first term is the dominant term and is inversely proportional to (OMEGA – omega)/sup ½/, where OMEGA and omega are the proton gyrofrequency and the wave frequency, respectively. The contribution from the second term, which is inversely proportional to (OMEGA – omega)/sup 7/2/, is about 10 percent of the first term. It is shown that the group travel time is sensitive to the variation of temperature, gradient of proton gyrofrequency, and ion density along the path of a proton whistler. The effect of variation in each of the above parameters on the group travel time is discussed, and it is shown that an estimate of proton temperature can be made from the measured data on the proton whistlers. (auth)

18210 METASTABLE ^2P OXYGEN IONS IN THE DAYTIME THERMOSPHERE. Walker, J. C. G. (Yale Univ., New Haven); Torr, D. G.; Hays, P. B.; Rusch, D. W.; Docken, K.; Victor, G.; Oppenheimer, M. J. Geophy. Res.; 80: No. 7, 1026-1029(1 Mar 1975).

Dayglow radiation at 7319 A has been measured by the visible airglow experiment on Atmosphere Explorer C. The overhead surface brightness measured at 15.4 hours local solar time on January 27, 1974, was 250 +– 10 R. The volume emission rate had a peak value of 20 photons cm^{-3} s^{-1} at a height of about 210 km. The data show clear evidence of quenching by collisions with thermal electrons at the higher altitudes and with neutral particles at lower altitudes. Quenching by neutral particles occurs at nearly the gas kinetic rate. (auth)

18211 PLANETARY PRIMORDIAL COMPONENT OF RARE GASES IN THE DEEP EARTH. Fisher, D. E. (Univ. of Miami, FL). Geophys. Res. Lett.; 1: 161-164(Aug 1974).

Measurements of argon, krypton, and xenon in basalts dredged from several deep sea locations are reported, one of which may indicate entrapment of planetary primordial gases. The presented data support an earlier suggestion that xenon might have been depleted in the earth's atmosphere by selective adsorption. (IAA)

18212 IONOSPHERIC MID-LATITUDE TROUGH AND THE ABRUPT SCINTILLATION BOUNDARY. Kersley, L.; Van Eyken, A. P.; Edwards, K. J. (Univ. Coll. of Wales, Aberystwyth, Eng.). Nature (London).; 254: No. 5498, 312-313(27 Mar 1975).

It is stated that the mid-latitude electron density trough and the equatorward limit of small scale F-region irregularity structure apparent in the scintillation of satellite and radio star signals, known as the scintillation boundary, are both features of the transition region between the high and mid-latitude ionospheres, and that there are broad similarities between the morphology and statistical behaviour of the trough and the irregularity boundary. Although the individual behaviour of the scintillation boundary and the mid-latitude trough may be related to particle precipitation patterns or plasma pause movements, there is a definite local time variation in their mean relative latitudinal positions when simultaneous observations of the two phenomena are analysed. This variation was analysed in detail using data from simultaneous observations of trough and scintillation boundary positions. It is concluded that the mid-latitude trough and the scintillation boundary, although both features of the high to mid-latitude ionosphere interface, are essentially independent, having distinct diurnal behaviour patterns. It must therefore be supposed that the immediate causative mechanisms, whether in terms of particle precipitation, plasmapause behaviour, electric field effects, or some more complex process involving plasma waves, are also essentially unrelated. (UK)

18213 HIGH-POWER RADAR STUDIES OF THE IONOSPHERE. Evans, J. V. (Massachusetts Inst. of Tech., Lexington). Electron. Power.; 21: No. 6, 373-377(3 Apr 1975).

Fifty years ago, the first experiments were conducted that provided unequivocal evidence for the existence of an electrically charged region in the upper atmosphere capable of reflecting radio waves. Properties of the upper atmosphere have been studied by many recent measurements made during rocket and satellite flights. The theory of the scattering of radio waves by a warm plasma is considered and the uses for which incoherent scattering observations have been used, discussed. These include measurement of the electron density as a function of altitude and time, measurements of neutral winds and the investigation of the effect of the solar wind. Proposed new facilities for incoherent scatter radar work, including radar capable of studying the upper atmosphere at very high latitudes, are outlined. (UK)

18214 PRODUCTION OF NITRIC OXIDE BY COSMIC RAYS IN THE MESOSPHERE AND STRATOSPHERE. Nicolet, M. (Institut d'Aeronomie Spatiale de Belgique, Brussels). Planet. Space Sci.; 23: No. 4, 637-649(Apr 1975).

Nitric oxide is formed in the atmosphere through the ionization and dissociation of molecular nitrogen by galactic cosmic rays. One NO molecule is formed for each ion pair produced by cosmic ray ionization. The height-integrated input (day and night) to the lower stratosphere is of the order of 6×10^7 NO molecules cm^{-2}/sec in the auroral zone (geomagnetic latitude $\Phi \geq 60°$) during the minimum of the sunspot cycle and 4×10^7 NO molecules cm^{-2}/sec in the subauroral belt and auroral region ($\Phi \geq 45°$) at the maximum of solar activity. The tropical production is less than 10^7 NO molecules cm^{-2}/sec above 17 km and at the equator the production is only 3×10^6 NO molecules cm^{-2}/sec. (auth)

18215 EFFECT OF SOLAR COSMIC RAYS ON THE MEAN LATITUDE IONOSPHERE ON JANUARY 24th AND SEPTEMBER 1ST 1971. Nestorov, G.; Velinov, P. Izv. Geofiz. Inst., Bulg. Akad. Nauk.; 22: 55-71(1974). (In Bulgarian).

The effect of solar cosmic rays from January 24 and September 1, 1971, and of solar corpuscular fluxes after that period, on the lower, medium, and upper ionospheres, located at mean latitudes, is discussed. Owing to this, qualitative and quantitative analyses are made of the effect of solar particles during a long time interval, namely, from January 24 to February 3 and August 28 to September 8, thus embracing the whole totality of the complex and interrelated phenomena in the Sun–Earth space in the periods indicated. For the most part ionospheric data, obtained at the ionospheric observatory in Sofia, were used, and the effects studied were recorded on a wide frequency range, thus securing the observation of corpuscular effects on the ionosphere at different altitudes. Quantitative evaluations and discussions about the effect of PCA particles on the ionosphere at mean latitudes were given. (auth) (7 figures)

18216 SOLAR DISTURBED VARIATIONS IN THE SCALE HEIGHT OF THE LOWER AND MEDIUM IONOSPHERE. Serafimov, K. Izv. Geofiz. Inst., Bulg. Akad. Nauk.; 22: 73-84(1974). (In Bulgarian).

Possibilities were analyzed to obtain the gradient of the scale height and, under certain conditions, to find the temperature gradient from the exponent of the cosine dependences of the f_{min}, f_0E, fE_s, f_0E2 and f_0F1 ionospheric parameters. A suitable criterion was defined and used for the quiet state in long periods of disturbances (the interpolated value of the corresponding value between the medians for the corresponding moment of the fifteen-day periods, prior to and after the disturbance). The solar–terrestrial events in the period August 1–13, 1972, are discussed as an example. The exponents for the E, E_s, F1 layers, as well as that for the variants in the f_{min}, were analyzed. It was found that the normal, undisturbed values of the N_E and N_{Es} exponents are almost equal, while their increase in flare disturbances is equal. This confirms the general ionization mechanism, as well as the common source of energy dissipation in these two layers. It has been established also that $n^r_{min} < n_{F1} < n_E \approx n_{Es}$; this result confirms the presence of a relatively low mean temperature gradient in the D region, the maximum temperature gradient in the E layer, and

a decrease in that gradient at altitudes from 160 to 180 km. The highest increase (44.6 per cent) in the disturbance period discussed occurs for the exponent of the low-lying ionization D region and a part of the E layer, which cannot be probed, because the hard solar x radiation releases its energy in that region. There is a smaller rise in the exponent in the E region (the E and E_s layers), because the flare increases in the soft solar x radiation are smaller. The smaller rise is observed in the exponent of the F1 layer (160–180 km), because in its altitude area there are smallest energy flare losses. A rise in the preculmination retention of the electron concentration is observed in the E region in periods disturbed by flares, which is the result of intensified current systems during magnetic disturbances. As a whole, the analysis made indicates possibilities of obtaining aeronomic data by studying the exponent of cosine dependences of the ionospheric parameters on the solar zenith angle. (auth) (4 figures, 1 table)

18217 ROLE OF NEUTRONS IN THE FORMATION OF X-RAY PHOTONS IN THE STRATOSPHERE. Kvashnin, A. N.; Charakhch'yan T. N. (Lebedev Inst. of Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 491-495(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 579-583(1974).

The flux and energy spectrum of photons ($E_\gamma > 20$ keV) forming during the passage of γ-quanta with energies from 1 to 7 MeV through the atmosphere are computed by the Monte Carlo method. The sources of these γ-quanta are the nuclear reactions of thermal and fast neutrons in air. (4 tables) (auth)

18218 GENERATION OF THE CURRENT AND WIND SYSTEM IN THE IONOSPHERE BY THE MOTION OF MATTER IN THE PLASMASPHERE. Glushakov, M. L.; Samokhin, M. V. (Moscow Physical-Technical Inst.). Geomagn. Aeron. (Transl.).; 14: No. 4, 496-501(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 584-591(1974).

The current and wind system in the ionospheric dynamo region, produced by the electric field associated with the motion of plasmaspheric matter generated by magnetospheric convection is computed. It is demonstrated that for reasonable values of the convection rate, the computed current system agrees with the equivalent current system of S_q variations in topology, position of cells, and current amplitudes. The diurnal component of the neutral wind agrees in some parameters with observational data on the drift of ionospheric inhomogeneities in the lower ionosphere in winter. (1 table, 4 figures) (auth)

18219 DYNAMICS OF THE ENERGY SPECTRA OF INJECTED ELECTRONS IN THE SUBAURORAL IONOSPHERE. Ben'kova, N. P.; Kozlov, E. F.; Osipov, N. K.; Samorokin, N. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 508-512(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 598-603(1974).

The results are reported of an analysis of anomalous nighttime ionization in the subauroral ionosphere based on vertical sounding data, and photometric and riometric measurements in December 1971–January 1972 in Arkhangel'sk Province. Data are presented on the space-time variations of the energy spectra of auroral electrons with energies 0.06-50 keV. (2 figures, 2 tables) (auth)

18220 EFFECT OF IONOSPHERIC–PROTONOSPHERIC PLASMA FLUXES ON THE DISTRIBUTION OF THE ELECTRON-ION GAS ABOVE THE F_2-LAYER MAXIMUM. Mikhaylov, A. V. (Inst. of Applied Geophysics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 513-516(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 604-608(1974).

The effect of a plasma flux, given at the region boundary, on the effective scale height is investigated by solving the nonstationary continuity equation for electron density in the F_2 layer. The critical flux and the distribution of the electron-ion gas are analyzed. A comparison of the theoretical results with experimental data suggests the presence, during the daytime, of an upward directed plasma flux of $\sim 10^9$ cm^{-2} sec^{-1}. (2 figures) (auth)

18221 VERTICAL-LATITUDINAL DEVELOPMENT OF THE SEASONAL ANOMALY IN THE DAYTIME F_2 REGION. II. Fatkullin, M. N.; Boenkova, N. M.; Legen'ka, A. D.; Muradov, A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 517-521(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 609-614(1974).

This is a continuation of a theoretical investigation of models of the vertical-latitudinal distribution of the seasonal anomaly in the F_2 region and the topside ionosphere in the afternoon at low solar activity in the Northern Hemisphere. Allowance is made for seasonal variations in the neutral composition of the upper atmosphere, including the turbopause. An attempt is made to estimate the seasonal variations in neutral composition at turbopause level at various latitudes from ionospheric characteristics. It is shown that the best agreement with observational data is obtained from a model taking into account the decrease of n_{120} (O) and the increase of n_{120} (N_2) from winter to summer, in which case n (O) decreases and n(N_2) increases with latitude in summer. (2 figures, 2 tables) (auth)

18222 MINOR IONS IN THE IONOSPHERIC F_2 REGION. Deminov, M. G. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 522-527(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 615-621(1974).

An analytical representation of the vertical distribution of O^+, H^+, N^+, and He^+ ions is obtained with allowance for mutual diffusion, ambipolar diffusion, and major chemical processes for a stationary case under model assumptions on the composition of the ionosphere. The effect of these processes on the vertical ion distribution is estimated. Solutions for various limiting cases are analyzed. (2 figures, 2 tables) (auth)

18223 STRUCTURE OF THE LARGE-SCALE ELECTRIC FIELD IN THE HIGH-LATITUDE IONOSPHERE. III. Gurevich, A. V.; Krylov, A. L. (Lebedev Inst. of Physics, Moscow). Geomagn. Aeron. (Transl.); 14: No. 4, 528-531(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 622-626(1974).

In the electric characteristics of the field (potential, conductivity), were studied previously. Two possible violations of this smoothness, leading to the appearance of a polar electrojet, are investigated here. (3 figures) (auth)

18224 POLARIZATION IONOGRAMS AND COMPUTATION OF THE N(h) PROFILES OF THE IONOSPHERE. Danilkin, N. P.; Mal'tseva, O. A.; Faer, Yu. N. (Rostov-on-the-Don State Univ., USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 539-541(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 636-639(1974).

A method for separating a signal reflected from the ionosphere in a broad frequency range according to polarization, and the installation used for this purpose are described. Experimental polarization ionograms are presented. It is demonstrated that polarization ionograms considerably increase the amount of information in ground-based sounding for computing N(h) profiles. (auth)

18225 USE OF THE BACKSCATTER METHOD FOR STUDYING IONIZATION INHOMOGENEITIES AND THEIR MOTIONS IN THE IONOSPHERIC D REGION. Benediktov, E. A.; Grishkevich, L. V.; Ivanov, V. A.; Ignat'ev, Yu. A. (Gorky Radio Physic Inst., USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 546-550 (1974).

Translated from Geomagn. Aeron.; 14: No. 4, 645-650(1974).

The problem of finding the space-time correlation function of the field of a signal backscattered by ionization inhomogeneities is solved in the Born approximation in relation to physical conditions in the ionospheric D region. The scattered field is assumed to be Gaussian. (1 figure) (auth)

18226 SOME RESULTS OF A STUDY OF FLUCTUATION PHENOMENA DURING IONOSPHERIC PROPAGATION OF SW SIGNALS. Alimov, V. A.; Vdovin, Yu. D.; Getmantsev, G. G. (Gorky Radio Physic Inst., USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 551-554(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 651-655(1974).

The results are reported of a study of the statistical characteristics of SW signals on mid-latitude paths of a length $d \lesssim 1200$ km. The E_s layer is found to play an important role in the propagation of waves in the 18- to 23-MHz range. Mention is made of the effect of frequency averaging of received signal fluctuations, i.e., decrease in the intensity and increase in the duration of fluctuations of pulsed signals compared with monochromatic signals. Short-wave scattering in the ionosphere is markedly nonstationary. (4 figures) (auth)

18227 PROTON ACCELERATION IN THE MAGNETOSHEATH AND FORMATION OF A REFLECTED FLUX. Kovner, A. Sh.; Kovner, M. S. (Gorky State Univ., USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 577-580(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 680-683(1974).

The statistical mechanism of proton acceleration in the magnetosheath between the plasmapause and the bow shock wave is investigated. It is demonstrated that the protons are effectively accelerated, diffuse behind the shock wave, and form a flux whose density decreases markedly with decreasing angle between the magnetic field of the wind and the shock-wave front. (auth)

18228 RELATIONSHIP BETWEEN VARIOUS TYPES OF SPORADIC-E AND MAGNETIC ACTIVITY. Saksena, R. C. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 189-195(Sep 1974).

A study has been made of different types of sporadic-E and their relationships with magnetic activity. Evidence is given to suggest that the changes in the occurrence of low-type of E_s may

be related to changes in the magnetic field. Changes in the behavior of cusp-types of Es are considered to be related to the interaction between quiet solar and disturbed polar current systems. It has also been found that the superposition of low and high type Es has a magnetic dependence similar to that of flat-type. The complete opaque layer of Es with no F-region echo can exist only under special circumstances. (7 figs, 7 refs) (auth)

18229 SOME STATISTICAL PATTERNS OF δf_0F_2 ACCORDING TO THE RESULTS OF FAST-RUN OBSERVATIONS. Vsekhsvyatskaya I. S.; Sergeenko, N. P.; Yudovich, L. A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 621-622(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 730-731(1974).

The statistical patterns of fast-run samples of the variations in the critical frequencies of the ionospheric F_2 layer, δf_0F_2, produced by ionospheric inhomogeneities with a characteristic dimension of 10^2 M were investigated. A three parameter model based on the concept of a Poisson flow was used to describe the δf_0F_2 distribution. It is concluded that the model is adequate for describing both small and large inhomogeneous structure of the F_2 layer. (1 figure, 1 table) (SDF)

18230 LOW-FREQUENCY ELECTRON DENSITY PULSATIONS IN THE E REGION OF THE AURORAL IONOSPHERE. Bagno, Yu. D.; Osipov, K. K.; Osipov, N. K. (Kaliningrad State Univ., USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 623-625(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 732-734(1974).

A characteristic feature of the auroral ionosphere is the presence of quasi periodic electron density pulsations of the order of .01 Hz. This phenomenon is described by a continuity equation assuming that the density variations are due to fluctuations of the parameters of auroral particle fluxes and ionospheric relaxation processes. (1 figure) (SDF)

18231 COMPUTER SIMULATION OF THE DISTURBANCE IN ION DENSITY DURING THE MOVEMENT OF A SATELLITE IN THE IONOSPHERE. Sarychev, V. T. (Tomsk State Univ., USSR). Geomagn. Aeron. (Transl).; 14: No. 4, 625-626(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 735(1974).

The problem of ion density disturbances produced in the ionosphere by the movement of a satellite is solved numerically using the Monte Carlo method. The movement of a geomagnetic body along the field and across it is considered. (2 figures) (SDF)

18232 IONOSPHERIC VARIATIONS IN CUBA. Lyakhova, L. N.; Hill, G.; Gonzales, S. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 626-629(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 736-738(1974).

Variations of the critical frequency of the ionospheric F_2 layer with time are examined using data from the ionospheric station in Cuba. Deviations of f_0F_2 from monthly medians (Δf_0F_2) were calculated for quiet days, and both negatively and positively disturbed days. Correlation coefficients characterizing the temporal stability of ΔfoF_2 are tabulated. (2 figures, 2 tables) (SDF)

18233 TOTAL ELECTRON CONTENT OBSERVATIONS AT CALCUTTA WITH GEOSTATIONARY SATELLITE INTELSAT 2F2. Basu, S.; Bhar, J. N.; Das Gupta, A.; Guhathakurta, B. K.; Bhattacharya, G. N. (Inst. of Radio Physics and Electronics, Calcutta). Indian J. Radio Space Phys.; 3: No. 3, 207-211(Sep 1974).

Observations on a geostationary satellite over the Indian subcontinent have been carried out at Haringhata Field Station of the University of Calcutta (geogr. lat., 22° 58′N, long., 88° 30′E; magnetic dip, 32°N) with the help of INTELSAT 2F2 transmitting at 136.44 MHz. The Faraday fading data obtained during winter 1972-73 have been analyzed to determine electron content, slab thickness and effect of magnetic activity on nighttime content at a location with sub-ionospheric latitude of 20°N and longitude 90°E. The diurnal curves of electron content during the winter months indicate a range of about 1:12. A considerable day-to-day variability in the midday values as well as a variability in the time of onset for the afternoon decay is observed. The rate of increase in electron content after sunrise is substantially constant at 10^{15} el. m^{-2} min^{-1} up to about 0930 hrs IST and shows an abrupt increase thereafter by nearly a factor of 3 when ionization from the equatorial region diffuses into the local ionosphere. The period under study was marked by several weak-to-moderate magnetic storms, which induced high values of midnight content as large as 100% above the mean value. (6 figs, 7 refs) (auth)

18234 VELOCITIES OF PLASMA TRANSFER IN THE F-REGION OF THE IONOSPHERE. Khochalava, G. M. Soobshch. Akad. Nauk Gruz. SSR; 78: No. 1, 93-96(Apr 1975). (In Russian).

Using N(h) profiles, the values of ambipolar diffusion and drift of plasma due to horizontal wind of neutral atmosphere were calculated. The regularity of their altitude distribution was investigated, and the character of their relation with the level of geomagnetic activity was studied. (auth)

18235 AZIMUTHAL VARIATION OF GRAVITY WAVE INDUCED PERTURBATIONS IN THE F2 REGION ELECTRON DENSITY. Gupta, A. B. (University Coll. of Wales, Aberystwyth); Nagpal, O. P. Indian J. Radio Space Phys.; 3: No. 3, 212-215 (Sep 1974).

It has been established theoretically that ionospheric response to atmospheric gravity waves is anisotropic and depends, among other parameters, on the azimuth of the wave propagation. With this point in view, measurements on 24 occasions were made to study the magnitude of gravity wave-induced perturbations in the F2 region electron concentration at Delhi as a function of the wave-azimuth. The perturbations are indeed found to be azimuth-dependent and the results agree qualitatively with the theoretical predictions. (5 figs, 9 refs.) (auth)

18236 DIURNAL AND SEASONAL OCCURRENCE PATTERNS OF Pc AND Pi PULSATIONS AT CHOUTUPPAL (HYDERABAD), INDIA. Sarma, S. V. S.; Ramanujachary, K. R.; Narayan, P. V. S. (National Geophysical Research Inst., Hyderabad, India). Indian J. Radio Space Phys.; 3: No. 3, 221-226(Sep 1974).

Based on a detailed analysis of data covering a period of $3\frac{1}{2}$ years from February 1967 to September 1970, the diurnal and seasonal occurrence patterns of different types of pulsations have been studied. The present study indicated that both Pc1 and Pc2 pulsations at this station are mainly nighttime phenomena with a characteristic seasonal variation pattern showing a winter maximum for Pc1 and a summer maximum for Pc2 pulsations. The Pc3 type shows double maxima in the diurnal occurrence pattern centred around 0700 and 1300 hrs LT. The Pc4 activity exhibits a sharp morning peak around 0700 hrs LT while Pc5 shows two maxima around 0000 and 0900 hrs LT in diurnal occurrence pattern. The Pi pulsations show a midnight maximum in the diurnal pattern. As to the seasonal variation of activity level, the Pc3 and Pc5 pulsations do not show distinct difference between seasons, while Pc4 tends to have a summer enhancement. These features of pulsations observed at this station, which are relevant to this sub-equatorial zone, have been compared to those reported for high, middle and equatorial latitudes. (7 figs, 22 refs) (auth)

18237 OCCURRENCE OF SPORADIC E IN THE NAIROBI REGION. Kasenally, H.; Kelleher, R. F. (Univ. of Nairobi, Kenya). Indian J. Radio Space Phys.; 3: No. 3, 227-231(Sep 1974).

Sporadic E occurrence near Nairobi has been studied by means of a 27.8 MHz swept-azimuth oblique backscatter sounder from September 1969 to May 1971. The results are compared with ionosonde data for f Es and fbEs $\geq$ 5 MHz obtained over the period 1965–1970. A comparison is also made with predictions published by the Institute of Terrestrial Magnetism, Ionosphere and Radiowave Propagation, Moscow. (10 figs, 10 refs.) (auth)

18238 REGIONAL DIFFERENCES IN IONOSPHERIC SCINTILLATION NEAR THE MAGNETIC EQUATOR. Chatterjee, S. K.; Bandyopadhyay, A. K.; Guhathakurta, B. K.; Bandyopadhyay, P. (Univ. of Calcutta). Indian J. Radio Space Phys.; 3: No. 3, 248-252(Sep 1974).

Scintillation signals from a number of geostationary satellites (ATS-1, ATS-3 and the Canary Bird) were observed from Huancayo—a magnetic equatorial station in the American zone. The observations made during January 1967 to December 1968 are compared with those obtained at an African equatorial station, namely, Legon. The comparison shows some differences. Particularly remarkable are the seasonal patterns at the two places. The pattern at Huancayo shows a predominantly annual periodicity while that at Legon shows a primarily semi-annual variation. These differences are described here and discussed as zonal effects. (6 figs, 28 refs) (auth)

18239 SEASONAL ANOMALIES IN IONOSPHERIC F2-LAYER AT CONJUGATE PLACES. Parikh, N. K.; Kotadia, K. M. (Gujarat Univ., Ahmedabad, India). Indian J. Radio Space Phys.; 3: No. 3, 255-258(Sep 1974).

Seasonal anomalies in the disturbed-day variations of f0F2 are described. It is shown that f0F2 increases markedly at both the conjugate places during a northern winter month (December), although summer conditions prevail in the south. Further, the northern stations show more clearly the increase of f0F2 in winter and decrease in summer than at southern stations where increases as well as decreases are found in either season. However, the annual average DS variation shows increased values of f0F2 for most of the time in the south. In contrast, the DS variation of the horizontal component of the earth's magnetic field (H-field) is in phase opposition to that of f0F2 in the south, but not so in the north, although the magnitude of H-field variation

is larger in the northern winter month at both the conjugate places than in the southern winter month. The results indicate that besides electromagnetic drift of F2-ionization, the neutral wind-associated vertical drift of ionization and the change in gas composition brought about by thermospheric heating and air circulation might be effective in causing the changes in the F2-ionization on magnetically disturbed days at places with a magnetic dip of 40° to 60°. However, electromagnetic drift forces are more pronounced at low latitudes. (3 figs, 13 refs) (auth)

18240 AURORAL IONIZATION AND EXCITATION BY PRECIPITATING ELECTRONS: N_2^+ MEINEL AND O_2^+ FIRST NEGATIVE SYSTEM. Srivastava, B. N. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 259-262(Sep 1974).

Based on laboratory measurements of excitation functions of various N_2^+ Meinel and O_2^+ first negative bands excited by electron impact, the relative intensities of these band systems with respect to N_2^+ first negative (λ 3914 Å) have been estimated in a stable auroral arc. Also, other secondary excitation processes responsible for the excitation of N_2^+ Meinel band system have been discussed. It is observed that the total calculated intensity due to all processes responsible for the excitation of Meinel band system is not comparable to the absolute intensity reported in standard literature for different types of auroral form. (1 fig, 25 refs) (auth)

18241 SOLAR AND ELECTROJET CONTROL OF THE EQUATORIAL SPORADIC E. Setty, C. S. G. K.; Dahiya, R.; Verma, P. (Univ. of Delhi). Indian J. Radio Space Phys.; 3: No. 3, 263-268(Sep 1974).

Variations of Es with sunspot activity (R_z) have been studied, analyzing different parameters representing the Es layer, from the Ionospheric Data Bulletins. The percentage occurrence of f_bEs > 4 MHz is found to be the most reliable parameter for studying the structure of the Es layer from the point of view of the zonal representation. The behaviour of the occurrences of blanketing type of sporadic E, with regard to sunspot variation at the equatorial station Huancayo, is found to be markedly different from the behaviour observed at two other non-equatorial stations, Maui and Rarotonga. This difference in the behaviour observed at Huancayo is attributed to the equatorial electrojet control on the Es layer. A theoretical model has been given in terms of the equatorial electrojet control, which seems to explain satisfactorily the observed variations of the blanketing Es layer at Huancayo. (7 figs, 13 refs) (auth)

18242 CHARACTERISTIC STUDIES OF SUDDEN COSMIC NOISE ABSORPTION PHENOMENA. Sharma, M. C.; Sarma, S. B. S. S. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 269-272(Sep 1974).

During solar flares the electron density of the lower ionosphere (at heights between 65 and 100 km) increases considerably thereby increasing the ionospheric absorption (called the SCNA) during the flare event, as a function of time, which is found to be very well associated with the increase of solar X-ray flux in the wavelength band of 1-10Å. In the period 1963-70 several flare effects occurred on riometers operating at Delhi, and these have been investigated (in all about 80 events). It is observed that during these events, the ionized layer thus produced seems to obey an effective attachment law in some cases and an effective recombination law in the rest of the events. Thus, two distinct phenomena are observed. The X-ray flux observed by satellites Explorer 33 and 35 for typical events is utilized to derive the ion production rate and hence absorption, which is compared with the observed absorption. It is observed that the calculated absorption from the X-ray data and the observed absorption during SCNA do not compare well. Also, the solar zenith angle dependence of absorption during some events has been quantitatively studied. (6 figs, 14 refs) (auth)

18243 SOLAR ACTIVITY VARIATION OF ELECTRON AND ION TEMPERATURES IN EQUATORIAL TOPSIDE IONOSPHERE. Singh, R.; Rao, B. C. N. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 273-277(Sep 1974).

The daytime electron and ion temperature (T_e and T_i) profiles in the topside ionosphere in the equatorial region are theoretically investigated for low and medium solar activity conditions. The available ion composition data from incoherent back-scatter radar and satellite in situ measurements are used in studying the thermal structure. The local and non-local electron heating rates due to photoelectrons are evaluated for these solar activity conditions. The results show that the plasma temperature at 400 km as well as at 1000 km increases from low to medium solar activity conditions, while it decreases at 700 km. The altitudinal extent of the isothermal region around 500 km increases with increasing solar activity and the temperature gradient above the isothermal region is lower for medium solar activity as compared to low solar activity. The calculated temperature profiles are in fair agreement with the direct measurements of T_e and T_i taken at Jicamarca for similar conditions. (5 figs, 17 refs) (auth)

18244 CHANGES IN 164 kHz SIGNAL FIELD STRENGTHS DUE TO STELLAR X-RAY EFFECTS ON D-REGION NIGHTTIME IONIZATION. Ghosh, B. B.; Malhotra, V. J. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 278-281(Sep 1974).

Results of analysis showing some effects on the field strengths of 164 kHz signal from Radio Tashkent (41° 25′N, 69° 12′E) recorded at Delhi (28° 35′N, 77° 05′E) due to meridian transits of a few stellar X-ray bodies at the midpoint (35° 04′N, 73° 24′E) of Tashkent–Delhi propagation path, have been reported. While the effects due to SCO-XR-1 and TAU-XR-1 show rather significant results in respect of their "ion production rates" (cm^{-3} sec^{-1}), those due to other stellar X-ray sources, Gx. 333 + 2.5 and CYG-XR-1 are small and rather unaccountable. For each star, records for a period of two months, during which respective meridian transits take place between 1900 and 2300 hrs IST (UT + 5½ hrs), have been analyzed. (5 figs, 10 refs) (auth)

18245 If EFFECT AT LOW LATITUDES FOR THE SOLAR PROTON EVENT OF 4 AUGUST 1972. Sastri, J. H.; Subrahmanyam, C. V. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 282-283(Sep 1974).

Evidence for effect of solar particle precipitation at low latitudes is presented for the proton event of 4 August 1972. The effect is observed as a significant decrease in single strength of the If transmissions from Radio Tashkent (164 kHz) as received in Delhi. (auth)

18246 HYDROGEN AND OXYGEN ION DENSITIES AND FLUXES IN LOW AND MIDLATITUDE TOPSIDE IONOSPHERE. Rao, B. C. N.; Jain, V. C. (National Physical Lab., New Delhi). Indian J. Radio Space Phys.; 3: No. 3, 284-288(Sep 1974).

The daytime altitudinal variation of ion diffusion fluxes and their influence on H^+ and O^+ densities in the topside ionosphere in the low and midlatitudes are investigated theoretically, taking into account the ionosphere-protonosphere coupling. The H^+ density is considered to be in chemical equilibrium at altitudes below 600 km and in dynamical equilibrium at altitudes above 600 km. Using the observed O^+ ion densities, recently derived neutral hydrogen densities, and electron and ion temperature profiles, the transport fluxes of O^+ and H^+ ions are evaluated taking into consideration the geomagnetic field geometry. It has been shown that the relative sizes of the magnetospheric field tubes in the low and midlatitudes control the density variation in the topside ionosphere and produce lower proton densities in the midlatitudes compared to low latitudes. Also, the diffusive equilibrium profiles differ considerably from the dynamical equilibrium profiles. (auth)

18247 DRIFT MEASUREMENTS OF SOME LARGE SCALE IONOSPHERIC IRREGULARITIES AT KURUKSHETRA. Dutta, H. N. (Kurukshetra Univ., India). Indian J. Radio Space Phys.; 3: No. 3, 199-202(Sep 1974).

Faraday fading plots obtained by recording the radio transmissions at 40 MHz from the satellite BE-C at Kurukshetra (29.9°N, 76.8°E) have been utilized for the measurements of the magnitude and the direction of drift of some large scale ionospheric irregularities. In daytime, E-W component was towards west. Irregularities were found to move with a velocity ranging from 69 to 142 m/sec. (auth)

18248 DAY-TO-DAY VARIATION OF TOTAL ELECTRON CONTENT OF THE IONOSPHERE OVER HAWAII. Prakash, S. (National Council of Educational Research and Training, Bhopal, India). Indian J. Radio Space Phys.; 3: No. 3, 317-318(Sep 1974).

Published total electron content (TEC) versus time data obtained at Hawaii by measuring the Faraday rotation of the polarization of vhf telemetry carrier transmissions from the geostationary satellite, ATS-1, have been used to study day-to-day variation of TEC for the year 1970. Enhancement of TEC during quiet days, depression of TEC during quiet and disturbed days and appearance of secondary maximum have been discussed. It is believed that changes in the daytime coupling flux between ionosphere and protonosphere have an important role in day-to-day variations of TEC of the ionosphere. (3 figs. 3 refs) (auth)

18249 ROCKET MEASUREMENT OF ION, NEUTRAL AND ELECTRON TEMPERATURES IN THE LOWER IONOSPHERE. Sasaki, S.; Oyama, K.; Murasato, Y.; Yamori, A.; Kawashima, N. (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science). Tokyo Daigaku Uchu Koku Kenkyusho Hokoku; 10: No. 3, pt. B, 551-560(Sep 1974). (In Japanese).

A direct measurement of ion and neutral temperatures simultaneously in the lower ionosphere was successfully carried out

by a shadow method from a sounding rocket launched from Uchinoura, Japan, on September 22, 1973. The apparatus based on this method and the obtained data of ion and neutral temperatures together with electron temperature simultaneously measured by an electron probe are described in detail. The data are consistent with the prediction that ion, neutral, and electron temperatures are nearly equal to each other in the lower ionosphere and they show the existence of interesting gross structures in the temperature profiles of this region. (auth)

18250 EVIDENCE FROM PARTICLE PRECIPITATION OF TWO-WAY-CONVECTION IN AURORAL LATITUDES. Hultqvist, B. (Kungliga Vetenskapsakademien, Kiruna (Sweden). Geofysiska Observatoriet). J. Geophys.; 40: No. 6, 713-728(Dec 1974).

Latitudinal distributions of keV proton and electron fluxes in the upper ionosphere are shown to display reminiscences of the characteristics in the noon sector even past dawn and dusk on the nightside. These observations support the proposal of Frank that plasma is convected along the magnetospheric flanks from day to nightside. The keV-particle data show, however, that in most of the auroral particle precipitation zone the transport of hot plasma is from night to day. (auth)

18251 AN EVALUATION METHOD COMBINING THE DIFFERENTIAL DOPPLER MEASUREMENTS FROM TWO STATIONS THAT ENABLES THE CALCULATION OF THE ELECTRON CONTENT OF THE IONOSPHERE. Leitinger, R. (Graz Univ. (Austria). Inst. fuer Meteorologie und Geophysik; Oesterreichische Akademie der Wissenschaften, Graz (Austria). Inst. fuer Weltraumforschung); Schmidt, G. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz (F. R. Germany)); Tauriainen, A. (Oulu Univ. (Finland)). J. Geophys.; 41: No. 2, 201-213(Mar 1975).

Differential Doppler measurements of signals from NNSS Navigational Satellites can be used to give the electron content of the ionosphere. Measurements carried out up to now using data from one station provide limited information about the structure of the ionosphere, since the method relies on an assumption being made about the prevailing ionospheric conditions. If these conditions are not fulfilled, this method can lead to large errors in the predicted electron content. In the method described, differential Doppler data from two stations are combined, resulting in considerably more reliable results, particularly when there is strong horizontal structure in the ionosphere, as is often the case in polar regions. Examples of model calculations and experimental measurements are also included. (auth)

Effects of Nuclear Detonations

18252 (UCID-16784) IONOSPHERIC DISTURBANCES DUE TO UNDERGROUND NUCLEAR EXPLOSIONS AND OTHER SOURCES: AN ELEMENTARY DISCUSSION, PART I. Wouters, L. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Jan 1971. Contract W-7405-Eng-48. 108p. Dep. NTIS $5.45.

The possible effect of verticle ground surface motion on the ionosphere, as a consequence of acoustic propagation, is discussed. Estimates of R. F. phase path perturbations are developed for several representative sources and several propagative modes (both terrestrial and atmospheric). In particular, amplitude models for ionospheric density perturbations are used. The discrimination of earth quakes and nuclear explosive disturbances is considered and some detailed properties of the extended atmosphere are described. A list of references is provided. (SDF)

Magnetospheric Phenomena

Refer also to abstracts 17065, 17934, 18065, 18071, 18076, 18089, 18115, 18180, 18191, 18203, 18207, 18210, 18250, and 18383.

18253 (AD-755390) ROCKET AND SATELLITE EXPERIMENTS FOR THE MEASUREMENT OF THE PROPERTIES OF THERMAL AND HIGH ENERGY PLASMA. Final Report, 30 July 1971-30 September 1972. Ahmed, M.; Rao, L. D. V. (Regis Coll., Weston, Mass. (USA)). 2 Nov 1972. 68p. (AFCRL-72-0662). NTIS $3.00.

The work carried under this contract covers the routine reduction and analysis of data obtained from the Spherical Electrostatic experiments on board the OGO 1 and 3, INJUN 5 and ISIS-1 satellites. The data analyzed were examined and theoretical interpretations were made thereby enabling an understanding of the physical processes operating in the magnetospheric region of space. (auth)

18254 (AD-774043) SOLAR CYCLE VARIATIONS OF GEOMAGNETICALLY TRAPPED RADIATION. Final Report, 20 November 1968-30 June 1973. Holeman, E. C. (Franklin Pierce Coll., Rindge, N. J. (USA). Dept. of Research). 31 Jul 1973. Contract F19628-69-C-0139. 248p. (AFCRL-TR-73-481). NTIS $6.00.

Observations of energetic geomagnetically trapped protons at low altitudes were made during the period December 1968 through May 1973 in order to study the solar cycle variations of geomagnetically trapped proton radiation for the eleven year solar cycle dating from November 1961. These observations consist of a series of flux measurements of 55-MeV protons made on nuclear emulsion radiation detectors flown on recoverable Air Force satellites, flux measurements of 115-MeV protons made on a sample selected from these, and preliminary flux measurements of six to 35-MeV protons from the AFCRL particle identifier on Air Force satellite S72-1. These observations form the basis for a series of trapped proton radiation models with variable parameters which are capable of predicting angular distributions, differential fluxes, integral fluxes, and omnidirectional fluxes as a function of spacial geometry and time. (auth)

18255 (AD/A-001641) PARTICLE SATURATION OF THE OUTER ZONE: A NONLINEAR MODEL. Schulz, M. (Aerospace Corp., El Segundo, Calif. (USA)). 31 Oct 1974. 26p. (SAMSO-TR-74-231). NTIS $3.75.

Properties of the steady state and transient behavior of geomagnetically trapped radiation are analyzed by means of phenomenological equations that concisely summarize the operative dynamical processes. The equations provide for a realistic coupling between electromagnetic wave energy, particle intensity, and pitch-angle anisotropy in the context of the outer zone. Applications include magnetospheric enforcement of a limit on stably trapped particle flux, the smooth transition between weak pitch-angle diffusion and strong diffusion, parasitic particle precipitation by natural and man-made radio signals, natural and artificial injections of trapped radiation, and the consequence of magnetospheric cold-plasma injection. (GRA)

18256 (AD/A-002318) THEORETICAL INVESTIGATION OF SOLAR WIND-MAGNETOSPHERE INTERACTIONS AND ASTROPHYSICAL PLASMA PHENOMENA. Final Report, 15 September 1971-14 September 1974. Lerche, I. (Chicago Univ., Ill. (USA)). 15 Sep 1975. Contract F19628-72-C-0056. 53p. (AFCRL-TR-74-0458). NTIS $4.25.

Solar wind-magnetosphere interactions and astrophysical plasma phenomena are covered. First, some of the basic plasma physics of the cosmic rays seen at earth is considered in order to ascertain the behavior of such particles under the diverse conditions obtained in the interplanetary medium. Second, a sequence of papers dealing with kinematic dynamo theory and turbulence theory is presented. Kinematic dynamo theory is used to outline the physical conditions under which magnetic fields are generated and maintained in astrophysical bodies, leading to an investigation of some of the underlying rationale of turbulence theory. A sequence of papers dealing with radiation passing through, and being reflected from, moving media is also included. (GRA)

18257 QUIET-TIME CHARACTERISTICS OF MIDDLE-LATITUDE WHISTLER-MODE SIGNALS DURING AN 8-YR PERIOD. McNeill, F. A.; Andrews, M. K. (Dept. of Scientific and Industrial Research, Lower Hutt, New Zealand). J. Atmos. Terrest. Phys.; 37: No. 3, 531-543(Mar 1975).

Results of eight years of measurements on Whistler-mode signals from station NLK (18.6 kHz) propagating in the vicinity of $L = 2.5$ are presented. The statistics of occurrence indicate a considerable extent (at least 6000 km) for the longitudinal window within which it is assumed ducts must be if a signal is to be received at a particular station. A significant increase in signal amplitude 2 to 3 days after a magnetic storm is found. A consistent pattern is found in the nightly variations of Doppler shift, but there is a marked difference between the June and December solstice data. The magnitudes of the shifts are comparable with those expected from Sq electric fields, but there is little agreement between the predicted and observed variations of Doppler shift. This may be related to ionosphere-magnetosphere coupling fluxes. (auth)

18258 SEASONAL AND LONGITUDINAL VARIATIONS IN THE OCCURRENCE FREQUENCY OF MAGNETOSPHERIC IONIZATION DUCTS. Sharma, R. P.; Muldrew, D. B. (Communications Research Centre, Ottawa). J. Geophy. Res.; 80: No. 7, 977-984(1 Mar 1975).

Seasonal effects in the occurrence frequency of conjugate echoes on top side sounder ionograms recorded at nine telemetry stations, located at various longitudes, are studied by using Alouette 2, Isis 1, and Isis 2 satellite data. The combined data from all telemetry stations (2.8×10^5 ionograms) show minimums in the percentage of ionograms containing conjugate echoes at the equinoxes (2 percent) and maximums in the percentage of ionograms containing conjugate echoes at the solstices (about 7 per-

cent). However, data recorded at a single telemetry station may show a maximum at only one of the solstices depending upon the longitude of the station. A geometric model based on these results and on the observation that conjugate echoes are observed mainly during the nighttime hours is presented. According to this model, the conjugate ducts tend to be created when the angle between the geomagnetic axis and the normal to the plane of the ecliptic is maximum, that is, when the conjugate points of magnetic field lines are most asymmetric with respect to the sun-earth line. Magnetospheric currents flowing from one hemisphere to the other along geomagnetic field lines are suggested as the cause of the field-aligned ionization irregularities which produce the observed conjugate echoes on top side sounder ionograms. (auth)

18259 QUIET TIME INFLATION OF THE INNER MAGNETOSPHERE IN THE AFTERNOON AND EVENING QUADRANTS. Lee, Y. C.; Cahill, L. J. Jr. (Univ. of Minnesota, Minneapolis). J. Geophy. Res.; 80: No. 7, 1003-1008(1 Mar 1975).

The quiet time depression of the magnetic field magnitude in the equatorial inner magnetosphere was studied for the interval November 1971 through June 1972. For periods when Kp was less than 2 and Dst was between +10 and −20 gamma an inflated field region near the magnetic equator was found between noon and midnight. The inflation was greatest at the lowest altitude studied, L equals 3, and appeared to be somewhat greater near midnight, −40 gamma, than near noon, −20 gamma. Protons of energy above 100 keV observed on the same satellite appeared to be sufficient to produce the quiet time inflation. (auth)

18260 FURTHER STUDIES OF LONG-PERIOD PULSATIONS IN IONOSPHERIC ABSORPTION AT AURORAL ZONE LATITUDES. Brown, R. R. (Univ. of California, Berkeley). J. Geophy. Res.; 80: No. 7, 1023-2025(1 Mar 1975).

The magnetic local time distribution of long-period absorption pulsations has been determined for sites from L equals 4 to L equals 13.5. In addition, satellite crossings of unstable boundary regions of the magnetosphere have been used to study the correlation between the Kelvin-Helmholtz instability and pulsating ionospheric absorption. The results of this study show that almost half of the instances of boundary instability are accompanied by simultaneous absorption pulsations. (auth)

18261 STRUCTURE OF THE QUASI-PERPENDICULAR LAMINAR BOW SHOCK. Greenstadt, E. W. (TRW Systems Group, Redondo Beach, CA); Russell, C. T.; Scarf, F. L.; Formisano, V.; Neugebauer, M. J. Geophy. Res.; 80: No. 4, 502-514(1 Feb 1975).

The earth's bow shock was observed several times at high resolution on February 12, 1969, by an array of Ogo 5 field and plasma instruments under unusual circumstances: the field was at large angle to the local shock normal, the solar wind parameters M and beta were both low enough to ensure laminar shock structures, upstream parameters were verified by complementary measurements by Heos 1, and approximate shock velocities were available by virtue of elapsed time observations obtained with the two satellites. It was found that the low M (less than 2.5) and beta (less than 1) and high theta/sub nB/ (greater than 65^0) produced oblique laminar shock profiles as expected from theory, with marginal or vanishing upstream standing whistlers probably damped by acoustic or other plasma wave instabilities. The whistler mode appeared to dominate the electromagnetic spectrum. The laminar shock ramp thickness was several hundred kilometers and equal to (2–4)c/omega/sub pl/. Composition of the shock as an accumulation of near-standing waves and an evidently reproducible varying flux pattern was discernible. Electron thermalization occurred early in, or just before, the magnetic ramp, while proton thermalization appeared to occur later in the ramp. Instantaneous shock velocities derived from the standing whistler wavelength were consistent with average velocities derived from the elapsed time estimates and were as high as 200 km/s. (auth)

18262 QUANTITATIVE MAGNETOSPHERIC MODEL DERIVED FROM SPACECRAFT MAGNETOMETER DATA. Mead, G. D.; Fairfield, D. H. (Goddard Space Flight Center, Greenbelt, MD). J. Geophy. Res.; 80: No. 4, 523-534(1 Feb 1975).

A quantitative model of the external magnetospheric field has been derived by making least squares fits to magnetic field measurements from four Imp satellites. The data were fit to a power series expansion in the solar magnetic coordinates and the solar wind-dipole tilt angle, and thus the model contains the effects of seasonal north-south asymmetries. The expansion is divergence free, but unlike the usual scalar potential expansion, the model contains a nonzero curl representing currents distributed within the magnetosphere. The model includes four sets of coefficients, representing different degrees of magnetic disturbance as determined by the range of Kp values. The latitude at the earth separating open polar cap field lines from field lines closing on the day side is about 5^0 lower than that determined by previous theoretically derived models. At times of high Kp, additional high-latitude field lines extend back into the tail. Near solstice, the separation latitude can be as low as 75^0 in the winter hemisphere. The average northward component of the external field is much smaller than that predicted by theoretical models; this finding indicates the important effects of distributed currents in the magnetosphere. Current densities implied by the model are of the order of 10^{-9} A/m^2 across the magnetotail. (auth)

18263 MAGNETOSPHERIC MAPPING WITH A QUANTITATIVE GEOMAGNETIC FIELD MODEL. Fairfield, D. H.; Mead, G. D. (Goddard Space Flight Center, Greenbelt, MD). J. Geophy. Res.; 80: No. 4, 535-542(1 Feb 1975).

The Mead-Fairfield geomagnetic field model has been used to trace field lines between the outer magnetosphere and the earth's surface. The results are presented in terms of ground latitude and local time contours projected to the equatorial plane and into the geomagnetic tail. With these contours, various observations can be mapped along field lines between high and low altitudes. Low-altitude observations of the polar cap boundary, the polar cusp, the energetic electron trapping boundary, and the sunward convection region are projected to the equatorial plane and compared with the results of the model and with each other. The results provide quantitative support to the earlier suggestions that the trapping boundary is associated with the last closed field line in the sunward hemisphere, the polar cusp is associated with the region of the last closed field line, and the polar cap projects to the geomagnetic tail and has a low-latitude boundary corresponding to the last closed field line. The sunward convection region is associated with most of the magnetosphere outside the plasmapause, but whether the region extends all the way outward to the last closed field line or inward to the plasmapause is uncertain. Field lines from 6.6 R/sub E/ in the geomagnetic equatorial plane intersect the earth between 67.4^0 and 65.1^0, the exact value depending on the dipole tilt angle, season, local time, and geomagnetic activity. (auth)

18264 FREQUENCY-TIME BEHAVIOR OF ARTIFICIALLY STIMULATED VLF EMISSIONS. Stiles, G. S.; Helliwell, R. A. (Stanford Univ., CA). J. Geophy. Res.; 80: No. 4, 608-618(1 Feb 1975).

Artificially stimulated VLF emissions (ASE's) are emissions triggered in the magnetosphere by the whistler mode signals from VLF transmitters. These emissions may be separated into two classes, rising and falling, depending on whether the final value of df/dt is positive or negative. Several hundred ASE's triggered by three transmitters have been analyzed using the fast Fourier transform with a filter spacing of 25 Hz and an effective filter width of about 45 Hz. The study was limited to the initial frequency-time behavior of ASE's. Averages taken over many events reveal that both rising and falling tones show the same initial behavior. The emissions begin at the frequency of the triggering signal. Both tones initially rise in frequency, falling tones reversing slope at a point 25–300 Hz above the triggering signal. The slope of rising tones, particularly those triggered by NAA, often abruptly levels off in this same frequency range; as a result, a short (approximately 40 ms) plateau is formed that precedes the final rising phase. The initial frequency offset commonly observed in individual events appears to result from the frequent coincidence with this plateau of a peak in amplitude. Emissions stimulated by all three transmitters show essentially the same features; this finding indicates that their frequency behavior does not depend strongly on transmitter power. The process appears to be asymmetric in frequency; no evidence of initial growth below the triggering frequency has been found. (auth)

18265 DOPPLER PROFILE MEASUREMENTS OF THE GEOCORONAL HYDROGEN BALMER ALPHA LINE. Atreya, S. K. (Univ. of Pittsburgh); Hays, P. B.; Nagy, A. F. J. Geophy. Res.; 80: No. 4, 635-638(1 Feb 1975).

Results of high-resolution measurements of the geocoronal hydrogen Balmer alpha line profile made during several nights in December 1971, May 1972, and October 1972 are presented. The measured intensities are found to be in general agreement with the theory and earlier measurements under essentially similar conditions, and the measured geocoronal hydrogen temperatures are found to be somewhat lower than the Jacchia (1971) model exospheric values. (auth)

18266 OBSERVED VARIATIONS OF THE EXOSPHERIC HYDROGEN DENSITY WITH THE EXOSPHERIC TEMPERATURE. Bertaux, J. L. (Centre National de la Recherche Scientifique, Verrieres le Buisson, France). J. Geophy. Res.; 80: No. 4, 639-642(1 Feb 1975).

Measurements of exospheric hydrogen densities at a distance of 3 earth radii are presented as a function of exospheric temperature. They imply that the density at the exobase level decreases with exospheric temperature but not enough to keep the Jeans escape flux F/sub J/ constant. The increase of F/sub J/ with exospheric

temperature may be compensated for by the decrease of F/sub e/, which measures the loss of hydrogen by charge exchange in the plasmasphere. The two fluxes would be equal to 6.6×10^7 atoms $cm^{-2} s^{-1}$ at a temperature T/sub c/ equals 1070^0K, giving a total escape flux in agreement with measurements of hydrogen compounds in the region from 30 to 50 km and theoretical mesospheric calculations. (auth)

18267 PLASMA WAVE TURBULENCE AT DISTANT CROSSINGS OF THE PLASMA SHEET BOUNDARIES AND THE NEUTRAL SHEET. Scarf, F. L. (TRW Systems Group, Redondo Beach, CA); Frank, L. A.; Ackerson, K. L.; Lepping, R. P. Geophys. Res. Lett.; 1: 189-192(Sep 1974).

The orbit of IMP 7 frequently takes the spacecraft across the neutral sheet in the geomagnetic tail at a downstream distance of about 35 earth radii. This preliminary report discusses the detection of strong low-frequency electromagnetic signals and moderate electrostatic noise enhancements near local midnight. Data used were obtained during a substorm period on Oct. 28, 1972, when there were multiple crossings of the neutral sheet and the boundary of the plasma sheet. (auth)

18268 GEOACTIVE ZONES IN THE SOLAR WIND. Bobrov, M. S. Planet. Space Sci.; 23: No. 4, 627-636(Apr 1975).

Three parameters of the solar wind, proton number density n, Z-component of frozen-in magnetic field in solar ecliptic coordinates, and magnetic field variability ΔB, may be called geoactive parameters since each of them is responsible for a certain phase or stage of a geomagnetic storm. An undisturbed solar corpuscular stream differs from the quiet solar wind mainly in higher bulk velocity v; other parameters, in particular, n, Z and ΔB, are not enhanced in the stream. However, the examination of a number of geomagnetic storms shows that v is not a geoactive parameter. Hence the corpuscular stream itself is not more geoactive than the quiet solar wind. The retarding of the corpuscular stream by the quiet solar wind results in various plasma deformations (compression, torsion, shear). This, in turn, leads to the creation, in the stream and ambient quiet solar wind, of geoactive zones. Each zone is characterized by the enhancement of some geoactive parameter. The entry of the Earth into a geoactive zone causes a corresponding phase or stage of a geomagnetic storm. The concept of geoactive zones is applied to the analysis of the geomagnetic storm of 8 to 10 July 1966. (auth)

18269 STANDING WAVES AT LOW MACH NUMBER LAMINAR BOW SHOCKS. Fairfield, D. A. (Goddard Space Flight Center, Greenbelt, MD); Feldman, W. C. J. Geophy. Res., 80: No. 4, 515-522(1 Feb 1975).

Explorer 43 data have been used to study 34 bow shock crossings observed from 5 to 16 R/sub E/ upstream from the average bow shock location. These shocks have magnetosonic Mach numbers between 1.2 and 2.0, and they display particularly simple laminar structures. In 17 of these cases waves are detected adjacent to and upstream of the shock with amplitudes ranging up to DELTA B/B equals 1 and period ranging from 6 to 130 s. The wave polarization relative to the average field direction is right-handed when the crossing is from the interplanetary medium to the magnetosheath but is left-handed when the crossing is made in the opposite direction. On the basis of these observations the waves are identified as the standing whistler waves that have been predicted by the theory of low Mach number oblique shocks. The observed amplitude and the occasional lack of waves are in general agreement with theory, which predicts that decreasing amplitudes should correspond to larger field-shock normal angles and lower plasma betas. Variations in the observed frequencies can be explained by changes in the wavelength of the standing wave as upstream parameters change. Shock velocities calculated from theoretical wavelengths typically range from 10 to 30 km/s, but in one instance the velocity was 150 km/s. (auth)

18270 ELECTROMAGNETIC HISS AND RELATIVISTIC ELECTRON LOSSES IN THE INNER ZONE. Tsurutani, B. T. (California Inst. of Tech., Pasadena); Smith, E. J.; Thorne, R. M. J. Geophys. Res., 80: No. 4, 600-607(1 Feb 1975).

Broad band incoherent electromagnetic waves, called hiss, have been detected in the inner zone magnetosphere (L less than 2) by the search coil magnetometer aboard the polar orbiting satellite OGO6. The 200- to 1000-Hz emissions are detected almost exclusively during periods of strong geomagnetic activity, such as storms and substorms, and the hiss intensity is generally related to the level of magnetic activity. Inner zone hiss is principally a day side phenomenon with a local maximum between 12 and 18 hours in the vicinity of the postnoon sector of the plasmaspheric bulge. Characteristic lifetimes of inner zone electrons, calculated in order of magnitude fashion on the basis of pitch angle diffusion into the loss cone driven by the cyclotron resonant interaction, are found to range between 10 and 60 days. Most features of inner zone hiss can be explained by the hypothesis that hiss originates in the vicinity of the plasmapause as plasmaspheric hiss, which is then able to propagate into the inner zone. (auth)

18271 MAGNETIC FIELD NEAR THE REGION OF THE IONOSPHERE CONJUGATE WITH REGION OF ANOMALOUS IONOSPHERIC ELECTRICAL CONDUCTIVITY. Abramov, L. A. (Inst. of Space Research, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 651-653(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 760-762(1974).

The flow of a constant horizontal current around a high latitude zone of anomalous ionospheric conductivity is investigated. The model used assumes conjugate points to be connected by an ideal conductor and that the current across the lines of force in the magnetosphere is negligibly small. The formulas obtained can also be used to estimate anomalous fields produced by regions of enhanced ionization. (1 figure) (SDF)

18272 APPEARANCE OF LONG-PERIOD PULSATIONS AT MIDDLE LATITUDES. Gogatishvili, Ya. M. (Inst. of Geophysics, Tbilisi, USSR). Geomagn. Aeron. (Transl.).; 14: No. 4, 658-660(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 767-768(1974).

The results of investigations of the patterns of appearance of Pc5 and Pi pulsations during SC storms are reported for middle latitudes using data from Dusheti for 1967-1969. A direct correlation is found between the amplitudes of long period pulsations and field variations in the initial phase of SC storms and an inverse correlation is observed in the main phase. (1 figure, 1 table) (SDF)

18273 TURBULENCE IN THE MAGNETOSPHERIC PLASMA AND ATTENUATION OF Pi2 PULSATIONS. Gudkova, V. A.; Barsukov, V. M.; Zelenyi, L. M.; Volosevich, V.; Loginov, G. A.; Liperovskii, V. A. (Inst. of Space Research, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 656-657(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 764-766(1974).

A study of plasma turbulence developing in the presence of fairly strong longitudinal currents in the magnetosphere during bays from the attenuation of SPP Pi2 was undertaken using a strict procedure for selecting pulsations. Conclusions are briefly discussed. (2 figures) (SDF)

18274 GENERATION OF AN ELECTRIC FIELD DURING QUASI-STATIONARY VARIATIONS OF THE MAGNETOSPHERE. Gurevich, A. V.; Krylov, A. L. (Lebedev Inst. of Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 654-655(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 763(1974).

Assuming that the outer boundary of the magnetosphere varies only slowly, equations are derived for determining the electric field produced by a variable magnetic field. As an example, the generation of an electric field in the magnetosphere during a quasi-stationary change in the north-south component of the interplanetary magnetic field is calculated. (SDF)

18275 HYDROMAGNETIC WAVES FROM SOURCES OF FINITE DIMENSIONS. Gokhberg, M. B.; Fedorov, E. E. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 587-592(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 691-697(1974).

It is demonstrated that one can estimate the effect of finite plasma conductivity along the external magnetic field on the propagation of directional low-frequency hydromagnetic waves by allowing for the finite dimension of the source. A justification is given for disregarding the anisotropy of the plasma and its finite conductivity along geomagnetic lines of force in the analysis of Pc3 and other low-frequency geomagnetic pulsations. (5 figures) (auth)

18276 ELECTRIC FIELD APPEARING IN THE EARTH'S MAGNETOSPHERE AS A RESULT OF THE MAGNETIC DRIFT OF FAST ELECTRONS. Timofeev, G. A.; Dorman, V. I.; Kopylova, T. M. (Moscow State Univ.). Geomagn. Aeron. (Transl.).; 14: No. 4, 581-586(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 684-690(1974).

Electric fields arising in the ionosphere during the drift of inhomogeneities consisting of fast electrons are investigated. It is assumed that the ionosphere is thin and its integral conductivities depend on latitude and longitude. A picture of ionospheric electric fields is obtained and their potentials and intensities are determined for various instants of time. (4 figures) (auth)

18277 TWO-DIMENSIONAL ANALYTICAL MODEL OF THE INTEGRAL TRANSVERSE CONDUCTIVITY OF THE MAGNETOSPHERE. Tsedilina, E. E. (Inst. of Terrestrial Magnetism,

Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (Transl.).; 14: No. 4, 502-507(1974).

Translated from Geomagn. Aeron.; 14: No. 4, 592-597(1974).

A two-dimensional analytical model of the integral transverse conductivity of the magnetosphere is proposed for equinoctial (symmetric model) and nonequinoctial (asymmetric model) conditions. The model reflects enhanced conductivity at high latitudes in the nighttime auroral zone and the daytime polar cap. (4 figures, 1 table) (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstract 18741.

18278 (BNL-tr-607) EXPERIMENTS ON SECONDARY EMISSION OF NEGATIVE HYDROGEN IONS. Bender, E. D.; Dimov, G. I.; Kishinevskii, M. E. 1975. Translation by S. J. Amoretty of IYaF-75-9. 17p. Dep. NTIS $4.00.

The emission of H^- ions following bombardment of tungsten and tantalum surfaces by CS^+ ions was investigated. To reduce the work function, the surfaces of these metals were continuously coated with cesium. Some experimental characteristics of the secondary emission of H^- ions were determined under different experimental conditions, with current densities of the bombarding ions in the range 1 to 10 mA/cm^2. Negative hydrogen beams with currents up to 2.5 mA were obtained at current densities up to 12 mA/cm^2. The coefficient of secondary emission of H^- ions was ≤ 80%. (GHT)

18279 (ORNL-tr-2968) INVESTIGATIONS ON SPUTTERING FROM SOLIDS WITH OBLIQUE ION BOMBARDMENT OF POLY-CRYSTALLINE METAL SURFACES IN THE ENERGY DOMAIN AT 1 keV. Oechsner, H. Translated by Ernest G. Silver from Z. Phys.; 261: 37-58(1973). 27p. Dep. NTIS $4.50.

The results are reported of an investigation of the dependence of the sputtering yield of various materials on the impact angle and energy of various bombarding noble gas ions. Comparison is made with other measured results and with theoretical predictions on the bombardment angle dependence in sputtering polycrystalline solids. (38 refs.) (GHT)

18280 DETERMINING THE ANGULAR DIVERGENCE OF AN INTENSE, ION BEAM. Ibadov, S. (Inst. of Astrophysics, Stalinabad, USSR). Dokl. Akad. Nauk Tadzh. SSR; 17: No. 11, 16-20(1974). (In Russian).

This study considers a method of determining the angular divergence of an intense ion beam at the exit of an ion source, which is based on the use of an experimental curve for the fall of ion current passing through a diaphragm of known diameter at increasing, source-diaphragm distance. With the use of this method it is not necessary to introduce additional, probe electrodes to measure the beam radius. Equations are given for the ion current as a function of distance from the beam center, azimuthal angle and beam current density in the plane of the electrode opening. The passage of a beam of 30 kev, positive hydrogen ions through an opening 1.15 cm in diameter is given as a function of the distance from the source. A value of 38×10^{-3} rad is calculated for the maximum divergence at half the angular opening. (SJR)

18281 CONTACT IONIZATION ION SOURCE. Hashmi, N.; Van Der Houven Van Oordt, A. J. US Patent 3,864,575. 4 Feb 1975. Priority date 25 Jul 1970, F. R. Germany. 6p.

An ion source in which an apertured or foraminous electrode having a multiplicity of openings is spaced from one or more active surfaces of an ionisation electrode, the active surfaces comprising a material capable of ionising by contact ionization a substance to be ionized supplied during operation to the active surface or surfaces comprises means for producing during operation a magnetic field which enables a stable plasma to be formed in the space between the active surface or surfaces and the apertured electrode, the field strength of the magnetic field being preferably in the range between 2 and 8 kilogauss. (auth)

18282 HISTORY OF MOLECULAR BEAM RESEARCH: PERSONAL REMINISCENCES OF THE IMPORTANT EVOLUTIONARY PERIOD 1919-1933. Estermann, I.; Foner, S.N., Editor (Applied Physics Laboratory, The Johns Hopkins University, Silver Spring, Maryland 20910). Am. J. Phys. 43: No. 8, 661-671 (Aug 1975).

Dr. Immanuel Estermann was engaged in writing a book on the History of the Molecular Beam Method when he died in Haifa, Israel on 31 March 1973. The original plan of the manuscript was to cover three distinct historical periods: the first, the years 1911–1933, when the center of research in molecular beams was at the University of Hamburg; the second, from 1933 to the outbreak of World War II, when the most active laboratory working in the field was at Columbia University; and the postwar period, when many laboratories on both sides of the Atlantic became actively engaged in this field. The material in this paper deals primarily with the early historical period and would have formed the essence of the first two chapters of the book. In addition to presenting interesting historical facts on a crucial period in the development of quantum physics, it contains some amusing historical sidelights on the research personalities that dominated that period. (auth)

18283 ELECTROSTATIC COMPONENT OF SELF-FOCUSING ELECTRON STREAMS. McCorkle, R.A. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). Phys. Rev. A 11: No. 6, 2152-2155 (June 1975).

Relativistic electron streams are shown to be both electrostatically and magnetically self-focusing; the electrostatic component can dominate. Moreover, steady-state reverse currents exist allowing steady-state stream currents in excess of the Alfvén limit. Many diverse phenomena (ion acceleration, stepped beam head and net current behavior, strong microwave generation) can be quantitatively understood as simultaneous-pinch phenomena. Limiting energies for axial acceleration of ions are given. Stream radius, focal length, limiting current, stream particle temperature, and plasma particle densities are calculated from initial conditions and are in agreement with experimental data. Conditions for target-implosion fusion studies are specified. (auth)

18284 ENERGY LOSS AND STRAGGLING OF 100–500-keV $_{90}$Th, $_{82}$Pb, $_{80}$Hg, AND $_{64}$Gd IN H_2. Hvelplund, P. (Institute of Physics, University of Aarhus, DK-8000 Aarhus C, Denmark). Phys. Rev. A 11: No. 6, 1921-1927 (June 1975).

Energy-loss distributions of $_{90}$Th, $_{82}$Pb, $_{80}$Hg, and $_{64}$Gd after passage through hydrogen are reported in the energy interval $100 < E < 500$ keV. The first three moments were extracted and compared with theoretical values of Lindhard *et al.* and reasonable agreement was obtained. Calculations of the energy-loss distributions were performed for the case where the projectiles lose their energy by elastic collisions with target atoms. Examples of calculated distributions are shown together with measured distributions. (auth)

18285 DEFLECTION OF A BEAM OF VIBRATIONALLY EXCITED MOLECULES IN AN INHOMOGENEOUS ELECTRIC FIELD. Alimpiev, S.S.; Karlov, N.V.; Prokhorov, A.M.; Sartakov, B.G. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 21: No. 5, 117-118 (5 Mar 1975).

A method is proposed for selecting vibrationally excited molecules by deflecting a beam of the molecules in an inhomogeneous electric field. With a molecule of the ZY_4 type and T_d symmetry as an example, it is shown that vibrationally excited molecules acquire in a sufficiently strong electric field a constant dipole moment comparable in order of magnitude with the dipole moment of the vibrational transition. An estimate of the possible deflection angles is given. (auth)

18286 STUDIES OF ATOMIC COLLISIONS IN SOLIDS BY MEANS OF CALORIMETRIC TECHNIQUES. Andersen, H. H. Aarhus, Denmark; University of Aarhus (1974). 279p. INIS.

Thesis (Ph. D.).

Results of the application of the calorimetric technique to measure the way in which the energy of particles passed through a thin foil and stopped within a solid block is distributed between the foil and the block are presented. This measurement gives the relative energy loss of the projectile in the foil and hence, since the foil thickness is measured independently, the stopping power. Calorimetric methods also allow accurate dosimetry of radiation damage measurements, and can be used to investigate the total energy reflected from a solid surface during heavy-ion bombardment. (DA)

18287 PATH LENGTH OF ELECTRONS WITHOUT ENERGY LOSS IN GERMANIUM. Kryn'ko, Yu. N.; Koval, I. F.; Mel'nik, P. V. (Kiev State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 3, 508-510(Mar 1975). (In Russian).

The variations of the quantity of electrons, elastically reflected in a solid angle from Ge layers of different thicknesses, deposited in high vacuum on Be substrates, were studied. The path length of electrons without energy loss in Ge was determined in the primary electron energy region from 0.6 to 10 keV. The results were compared with literature data in the energy region from 0.6 to 3 keV. In the region from 3 to 10 keV the dependence of the path length without energy loss on the primary electron energy has a linear character. (tr-auth)

18288 STOPPING POWER OF FAST CHANNELED PROTONS IN HARTREE-FOCK APPROXIMATION. Dettmann, K. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Z. Phys., A; 272: No. 3, 227-235(Mar 1975).

The electronic energy loss of MeV-protons in crystals is investigated in the Hartree-Fock approximation for the core electrons of the target. It turns out that each core electron can be regarded as stopping the proton independent of all other electrons without restriction by the Pauli principle. For the channeling stopping power the impact parameter dependent energy loss of a proton moving rectilinearly past a crystal ion is calculated in

first Born approximation. Low excitations of the core electrons lead to a long range impact parameter dependence, whereas high excitations contribute to the energy loss proportional to the electron density sampled along the proton trajectory. The results are applied to 4 MeV proton channeling along the main channels of Si using Clementi wave functions for the core electrons and a free electron approximation for the valence electrons. (GE)

18289 ENERGY LOSS OF CORRELATED PROTONS IN CHANNELLING. Arista, N. R.; Ponce, V. H. (Comision Nacional de Energia Atomica, San Carlos de Bariloche, Argentina). J. Phys., C (London); 8: No. 9, L188-L191(7 May 1975).

The angular average of the energy loss of H_2^+ ions channelled through thin crystals is obtained, for incident energies in the MeV range. The results show an important contribution to the energy loss coming from the correlated interaction of the protons with the valence electrons. (auth)

Atomic and Molecular Properties

Refer also to abstracts 17713–17715, 17965, 18052, 18330, 18332, 18334, 18335, 18337, 18365, and 18379.

18290 (ORNL-tr-2917) NUMERICAL CALCULATIONS OF THE 2S TERMS OF ORTHO- AND PARA-HELIUM. Hylleraas, E. A.; Undheim, B. Translated by R. G. Mansfield from Z. Phys.; 65: 759-752(1930). 14p. Dep. NTIS $4.00.

The basic term of ortho-helium and the second S term of para-helium were calculated as accurately as possible. In the first case, practically absolute agreement with the observed value was obtained; theoretically as well as experimentally the effective quantum number 1.689 is found. In the case of para-helium the difference between the observed and calculated values amounted to 7 parts per thousand of the energy relative to the "photo-electron" or 0.5 part per thousand of the total energy. In other words, in the calculation the effective quantum number 1.858 was found as compared to the experimentally determined value of 1.851. (auth)

18291 (UCID-16848) ENERGIES OF HYDROGEN AND HELIUM LIKE IONS FOR Z's FROM 6 TO 54. Scofield, J. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1975. Contract W-7405-eng-48. 15p. Dep. NTIS $4.00.

The energies and wavelengths for the 1s-np E1 transitions from the ground state are presented for hydrogen and helium like ions for Z's from 6 to 54 and for n up to 7. The transition energies for the hydrogen-like ions are obtained as the eigenvalues of the Dirac equation for a Coulomb potential including a finite nuclear size and corrected by interpolated values for the radiative corrections. Relativistic Hartree-Fock calculations are used to extend the accurate low Z calculations for helium-like ions into the higher Z region. (auth)

18292 ELECTRONIC TRANSITION MOMENT IN THE B $^1\Sigma_u^+$–X $^1\Sigma_g^+$ LYMAN BAND SYSTEM OF H_2 BASED ON KEV ELECTRON IMPACT EXCITED VACUUM UV EMISSION INTENSITIES. Schmoranzer, H. (Trier-Kaiserslautern Univ., Kaiserslautern, Ger.). J. Phys., B (London); 8: No. 7, 1139-1148(11 May 1975).

Vacuum UV emission intensities of H_2 molecules excited by keV electron impact are used for determining the dependence of the electronic transition moment on the internuclear distance in the Lyman band system for the region of 1.3 Å to 2.3 Å. A method of evaluation based on RKR and adiabatic calculation is discussed in comparison with electron impact spectroscopic results. The electronic transition moment in the Lyman band system is found to exhibit a maximum at about 1.6 Å as predicted by theory. (auth)

18293 ELECTRIC DIPOLE MOMENT OF HD^+ MOLECULAR ION. Saha, S. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys.; 48: No. 9, 849-852(Sep 1974).

The electric dipole moment of the HD^+ molecular ion was calculated. A numerical result is presented. (GHT)

18294 MODIFIED ORBITAL VALENCE FORCE FIELD CONSTANTS OF HEXAHALOANIONS OF Tc AND Re. Mithal, A. K.; Sharma, D. K.; Pandey, A. N. (Meerut Coll., India). Indian J. Phys.; 48: No. 9, 853-854(Sep 1974).

A modified orbital valence force field is applied to compute the force constants of some Hexahalo anions of transition metals: TcX_6^{2-} and ReX_6^{2-} (X = F, Cl, and Br) employing recent vibrational data. (GHT)

18295 VARIATION OF OPTICAL PROPERTIES OF ATOMS IN A DEBYE FIELD. Cizlunas, A. R.; Bogdanovic, P. O.; Savukynas, A. J. Opt. Spectrosc.; 38: No. 1, 97-98(Jan 1975).

Translated from Opt. Spectrosk.; 38: No. 1, 174-176(Jan 1975).

To calculate the effect of quasi-ideal plasma on atomic electrons, a static screened Debye–Hueckel Coulomb potential can be used. Results are given of a theoretical investigation of the fine structure of energy levels and line strengths of electric multipole transitions in a Debye field. A figure shows the dependence of radial integrals of spin–orbit interaction, which determine the magnitude of fine splitting of energy levels, on the Debye radius (D) for low-lying states of the H atom. The values of the radial integrals are plotted as ratios to the corresponding radial integrals of the free atom. The fine splitting of the energy levels is seen to decrease when the Debye radius decreases. Similarly, the variation of radial integrals of the electric dipole transition is shown. Radial integrals of transitions with $n = n'$ as well as radial integrals of the mean values of r increase as D decreases; radial integrals of transitions with $n \neq n'$ decrease with decreasing D. (2 figures) (RWR)

18296 SPECTRUM OF A HYDROGENLIKE ATOM IN A LASER-EMISSION FIELD. Zon, B. A.; Manakov, N. L.; Rapoport, L. P. Opt. Spectrosc.; 38: No. 1, 6-9(Jan 1975).

Translated from Opt. Spectrosk.; 38: No. 1, 13-19(Jan 1975).

A theory of the change in the spectrum of the hydrogen atom in intense fields of monochromatic optical radiation with an intensity comparable with the interatomic electric field strength is developed. (auth) (2 tables)

18297 RELATIVISTIC DECAY OF AUTOIONIZING STATES. Ivanov, L. N. Opt. Spectrosc.; 38: No. 1, 16-18(Jan 1975).

Translated from Opt. Sepctrosk.; 38: No. 1, 31-35(Jan 1975).

Widths of levels were calculated for the autoionizing states of highly charged heliumlike ions with $2s^2$ and $2p^2$ configurations. The system's Hamiltonian consists of a one-electron Dirac Hamiltonian and the electron–electron interaction, including relativistic corrections through terms in α^2. Autoionizing states are treated as solutions of the Schroedinger equation with complex energy. This treatment allows a diagrammatic technique developed for calculating the energies of degenerate states of atomic systems to be applied to the autoionizing states. A summation of divergent diagrams was made. (1 table) (auth)

18298 UNIMOLECULAR DISSOCIATION OF H_2^+ AND D_2^+. Maas, J. G., van Asselt, N. P. F. B.; Los, J. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam (Netherlands). Instituut voor Atoom en Molecuulfysica). Chem. Phys.; 8: No. 1, 37-45(Apr 1975).

Measurements are presented on the momentum distributions of fragments coming from unimolecular dissociation of H_2^+ and D_2^+. The observed spectra exhibit discrete peaks, correlated to excess energies less than 0.3 eV in the center of mass of the fragments. This feature could be explained as caused by rotational predissociation of high rotational states of the lowest electronic configuration of H_2^+ and D_2^+. After applying corrections for convolution effects by means of a computer simulation, the agreement between experiment and theory is very good, concerning both the energies and energy widths of the levels. (auth)

18299 METASTABLE STATES OBSERVABLE IN THE MASS SPECTRUM OF H_2. Peek, J. M. (Sandia Labs., Albuquerque, N. Mex. (USA)); Maas, J. G.; Los, J. (Stichting voor Fundamenteel Onderzoek der Materie, Amsterdam (Netherlands). Instituut voor Atoom en Molecuulfysica). Chem. Phys.; 8: No. 1, 46-55(Apr 1975).

Various states of H_2^+ metastable with respect to dissociation are considered in an attempt to explain non-integral peaks observed in the mass spectra of H_2 and its deuterium isotopes. The energies and widths for all metastable vibrational-rotational (VR) states in the electronic ground state of H_2^+, HD^+, and D_2^+ are presented. Two approximate calculation methods, the JWKB method and a method developed elsewhere, are used to generate the energies and widths. These methods are compared with each other and with the standard phase shift technique. The metastable VR states agree better with experiment than do electronic metastable states or one other proposed model. (auth)

18300 LAST RESOLVABLE LINE IN THE HYDROGEN SPECTRUM. Kurochka, L. N. (Kiev State Univ.). Sov. Astron. AJ (Engl. Transl.); 18: No. 4, 526-527(1975).

Translated from Astron. Zh.; 51: No. 4, 892-893(1974).

An equation is derived enabling the electron density in plasma to be determined from the number of the last resolvable line when both Stark and Doppler broadening are taken into account. (auth)

18301 MANY-BODY APPROACH TO HELIUM DOUBLE PHOTOIONIZATION. Talukdar, B.; Chatterji, M. (Department of Physics, Bolpur College, Bolpur-731204, West Bengal, India). Phys. Rev. A 11: No. 6, 2214-2216 (June 1975).

The Brueckner-Goldstone many-body theory is applied to study the photon-atom reaction $He(1s^2) + \gamma \rightarrow He^{++}(1s^2) + e + e$. An expression for the double-photoionization cross section is derived. The result is used to obtain the angular distribution of the ejected electrons. The effect of final-state correlation is examined. (auth)

18302 HYDROGEN-ANTIHYDROGEN INTERACTIONS. Kolos, W. (Max Planck Institute for Physics and Astrophysics, 8 Munich 40, Federal Republic of Germany); Morgan, D.L. Jr.; Schrader, D.M.; Wolniewicz, L. Phys. Rev. A 11: No. 6, 1792-1796 (June 1975).

Accurate quantum-mechanical calculations on the system hydrogen-antihydrogen ($H\bar{H}$) are presented. The energy is calculated using the Ritz variational principle, and is obtained as a function of the proton-antiproton distance in the Born-Oppenheimer approximation. It is everywhere lower and therefore more accurate than that recently calculated by Junker and Bardsley. In particular, the maximum in the interatomic interaction reported by these authors is not seen in this calculation. The cross section for rearrangement annihilation is calculated and found to be uniformly larger than that reported by Junker and Bardsley. (auth)

18303 HYDROGEN ATOMS IN STRONG MAGNETIC FIELDS. Brandi, H. S. (Departamento de Física, Pontifícia Universidade Católica do Rio de Janeiro, Brasil). Phys. Rev. A 11: No. 6, 1835-1839 (June 1975).

We propose a variational scheme for calculating the energy eigenvalues and eigenfunctions of the hydrogen atom in the presence of a strong magnetic field. Numerical calculations were performed for several of the lowest states, and for the wavelengths of some allowed transitions. We discuss briefly the equivalence of the problems related with solid-state physics and astrophysics, and compare our results with previous calculations. Because the suggested scheme converges very fast for fields up to approximately 10^9 G this is a convenient manner in which to treat problems where the interest is concentrated in the range of variation of the magnetic field from zero up to approximately 10^9 G. (auth)

18304 MEAN LIFE OF THE 27887-cm^{-1} LEVEL IN U I. Klose, J. Z. (National Bureau of Standards, Washington, D. C D. C. 20234). Phys. Rev. A 11: No. 6, 1840-1844 (June 1975).

Measurements of the mean life of the 27887-cm^{-1} level in U I have been made at a single vapor density using electronic excitation and a method of delayed coincidence. The lifetime values were obtained by optically detecting the decay of the 3584.9-Å resonance transition. Using branching ratios obtained from known relative f values, the average of the measured lifetimes was corrected for imprisonment of the resonance radiation, and absolute f values were derived from the corrected lifetime giving the following results: $\tau_0 = 7.3 \pm 1.1$ nsec, $f_{3585} = 0.18 \pm 0.03$, and $f_{4620} = 0.20 \pm 0.03$. The error given with each quantity is the standard deviation as determined from the dispersion of the individual measurements. A systematic error of 1% due to possible nonlinearities in the time scale of the system is also assigned to the results. Unaccounted for systematic errors affect only the correction in the measured lifetime, which is small compared to the statistical error. The lifetime and f values are presented in comparison with the experimental results of another group of workers. (auth)

18305 MEASUREMENT OF U I AND U II RELATIVE OSCILLATOR STRENGTHS. Voigt, P.A. (National Bureau of Standards, Institute for Basic Standards, Washington, D. C. 20234). Phys. Rev. A 11: No. 6, 1845-1853 (June 1975).

Relative gf values for 49 prominent U II lines and 21 of the strongest U I lines have been measured. The U II measurements were made using a wall-stabilized arc into which the uranium was introduced in the form of UF_6. The U I values were measured with a flow-stabilized arc which is essentially a free-burning arc stabilized by streaming argon around one of the electrodes which is formed from a molten ball of uranium held in a tungsten cup. Temperatures in the wall-stabilized and flow-stabilized arc were 10 500 K and 5500 K, respectively. The U I relative gf values were placed on an absolute scale employing a recent lifetime determination for the 27 887-cm^{-1} level of U II. This absolute scale was extended to the U I values by measuring the relative intensity of a U I and a U II line in the wall-stabilized arc. (auth)

18306 VARIATIONS IN BALMER-LINE STARK PROFILES WITH ATOM-ION REDUCED MASS. Wiese, W.L.; Kelleher, D.E.; Helbig, V. (Institute for Basic Standards, National Bureau of Standards, Washington, D.C. 20234). Phys. Rev. A 11: No. 6, 1854-1864 (June 1975).

Calculations of the Stark broadening of hydrogen lines treat the radiating atoms and the perturbing ions as quasistatic. The present experiment represents an attempt to determine whether the possible breakdown of this approximation near the center of the line can account, at least partially, for the existing discrepancies between theoretical and experimental profiles in the core of the Balmer lines. The central regions of H_α, H_β, H_γ, and H_δ profiles have been measured in a wall-stabilized arc over a range of atom-ion relative velocities by varying the atom-ion reduced mass. The cores of all four lines exhibit a significant dependence on the reduced mass. With increasing reduced mass, the experimental profiles gradually show more structure, but still less than the theories predict. Extrapolation of the results for H_α and H_β to infinite reduced mass, i.e., to the static case, gives results that agree quite well with recent calculations. (auth)

18307 RAYLEIGH SCATTERING OF PHOTONS BY HELIUM. Lin, C.; Cheng, K.; Johnson, W.R. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. A 11: No. 6, 1946-1956 (June 1975).

We present the results of a Dirac-Hartree-Fock calculation of Rayleigh scattering from He atoms in the energy range 0–500 Ry. The second-order S matrix is used to describe the scattering; the dominant correlation corrections are extracted from the fourth-order S matrix. The scattering amplitude is decomposed into a multipole series and numerical methods are employed to study the multipole amplitudes. For low photon energies the scattering is accurately described by a single electric-dipole amplitude; in this low-energy region correlation corrections modify the second-order amplitude significantly. At higher energies many multipoles contribute to the scattering; above 100 Ry the absorptive part of the second-order amplitude together with the fourth-order correlation corrections are negligibly small. For these very high energies the scattering is accurately described by a scattering form factor. (auth)

18308 R-MATRIX THEORY FOR ELECTRON-MOLECULE COLLISIONS USING ANALYTIC BASIS-SET EXPANSIONS. II. ELECTRON H_2 SCATTERING IN THE STATIC-EXCHANGE MODEL. Schneider, B.I. (Los Alamos Scientific Laboratory, Theoretical Division, P. O. Box 1663, Los Alamos, New Mexico 87544). Phys. Rev. A 11: No. 6, 1957-1962 (June 1975).

The R-matrix formalism developed by the author to treat scattering from nonspherically symmetric potentials is applied to the scattering of electrons from H_2 in the static exchange approximation. Calculations were performed for Σ_g, Σ_u, Π_g, and Π_u symmetries and phase shifts extracted for s, p, and d partial waves. The inclusion of p orbitals on each center was found to be essential in representing d-wave contributions to the phase shift and to have a non-negligible effect on p-wave scattering. The results are in good agreement with other calculations based on the static-exchange model using entirely different numerical techniques. We conclude by discussing the outlook for the method and how it may be extended to treat polarization, correlation, and inelastic processes. (auth)

18309 CALCULATION OF AUTOIONIZATION OF He AND H^- USING THE PROJECTION-OPERATOR FORMALISM. Bhatia, A.K.; Temkin, A. (Theoretical Studies Group, Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, Maryland 20771). Phys. Rev. A 11: No. 6, 2018-2024 (June 1975).

Improved calculations of the first several autoionization states of the lower symmetries ($^{1,3}S$, $^{1,3}P^o$, $^{1,3}D^e$) are reported. Unshifted energies are obtained by diagonalizing QHQ using a Hylleraas basis with more terms than used previously. Shifts, widths, and photoabsorption shape parameters q (where appropriate) are obtained with the additional use of exchange approximate nonresonant continuum functions. Our previous calculations of H^- resonances are recapitulated and slightly augmented by using various improved nonresonant continua and correcting small previous errors. Comparison with other calculations and experiments is made. The latter is very satisfactory except for the lowest ^1P autoionization state of He for which a more accurate experimental result is required. (auth)

18310 DERIVATION OF THE DIPOLE APPROXIMATION FROM THE EXACT TRANSITION PROBABILITIES FOR HYDROGEN ATOMS. Moses, H.E. (Air Force Cambridge Research Laboratories, Hanscom Air Force Base, Massachusetts 01731). Phys. Rev. A 11: No. 6, 2196-2197 (June 1975).

The usual dipole approximation for the transition probabilities for hydrogen atoms is derived from the exact transition probabilities by considering $j = 1$ photons only, neglecting retardation, and using an identity derived from the wave equation for the radial wave function for the atom. (auth)

18311 ELASTIC AND INELASTIC SCATTERING OF 40 eV ELECTRONS FROM ATOMIC AND MOLECULAR BISMUTH. Williams, W. (Jet Propulsion Lab., Pasadena, CA); Trajmar, S.; Bozinis, D. G. J. Phys., B (London); 8: No. 6, L96-L99 (21 Apr 1975).

Differential and integral electron impact cross sections for elastic scattering and for excitation of the first four electronic states of bismuth have been determined at 40 eV impact energy. The cross sections were normalized to the absolute scale by using the optical f-value of the $6p^37s^4P_{\frac{1}{2}}$ transition. The integral cross sections for elastic scattering ($6p^3\ ^4S_{\frac{3}{2}}$) and for the excitation of the $6p^3\ ^2D_{\frac{3}{2}}$, $^2D_{\frac{5}{2}}$, $^2P_{\frac{1}{2}}$ and $6p^27s^4P_{\frac{1}{2}}$ states are: 45.0, 0.29, 0.46, 0.17 and 3.8×10^{-16} cm^2, respectively. Inelastic scattering from Bi_2 molecules was also detected. (auth)

18312 ARE ELEMENTS 112, 114, AND 118 RELATIVELY INERT GASES? Pitzer, K.S. (Department of Chemistry and Inorganic Materials Research Division of the Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). J. Chem. Phys. 63: No. 2, 1032-1033 (15 July 1975).

Initial results of the application of relativistic Hartree-Fock (DHF) orbitals to the covalent bonding of elements 112, 114, and 118 lead to the conclusion that these elements are volatile and relatively inert. (AIP)

18313 TEMPERATURE DEPENDENCE OF THIRD ORDER ION MOLECULE REACTIONS. THE REACTION $H^+_3+2H_2 = H^+_5+H_2$. Hiraoka, K.; Kebarle, P. (Chemistry Department, University of Alberta, Edmonton, Alberta, Canada T6G 2E1). J. Chem. Phys. 63: No. 2, 746-749 (15 July 1975).

The rate constants k_1 for Reaction (1): $H^+_3+2H_2 = H^+_5+H_2$ were measured in the temperature range 100-300 °K. The temperature dependence of k_1 has the form $k_1 \propto T^{-n}$, where $n = 2.3$. Pierce and Porter have reported a much stronger negative temperature dependence with $n=4.6$. The difference arises from a determination of k_1 at 300 °K obtained by Arifov and used by Porter. The present k_1 (300 °K) $=9\times10^{-30}$ (cm^6 molecules^{-2}·sec^{-1}). This is more than an order of magnitude larger than the Arifov value. The temperature dependence of third body dependent association reactions like (1) is examined on the basis of the energy transfer theory and the recently proposed trimolecular complex transition state theory by Meot-Ner, Solomon, Field, and Gershinowitz. The temperature dependence of the rate constant for the reverse reaction (−1) is obtained from k_1 and the previously determined temperature dependence of the equilibria (1). k_{-1} gives a good straight line Arrhenius plot leading to k_{-1} $=8.7\times10^{-6}\exp(-8.4/RT)$ cm^3 molecules^{-1}·sec^{-1}. The activation energy is in kcal/mole. The preexponential factor is much larger than the rate constant for Langevin collisions. This is typical for pyrolysis of ions involving second order activation. (auth)

18314 SELF-CONSISTENT FIELD CALCULATION OF THE ELECTRONIC STRUCTURE OF THE URANYL ION (UO_2^{++}). Boring, M.; Wood, J.H. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544); Moskowitz, J.W. J. Chem. Phys. 63: No. 2, 638-642 (15 July 1975).

Using the multiple-scattering $X\alpha$ method the electronic ground state ($^1\Sigma^+_g$) of the UO_2^{++} molecule has been calculated self-consistently. The self-consistent calculations were performed at three U–O bond distances [3.269, 4.269, and 5.269 (a.u.)]. The four highest occupied one-electron levels (σ_g, σ_u, Π_g, Π_u) of the ground state, which have received so much attention in the past, change ordering with decreasing bond distance but are so close in energy that the ordering may be unimportant in determining the absorption spectra. We have also computed the electronic transition energies for the excitations $^1\Sigma^+_g \rightarrow {}^{1,3}\Phi_g(\sigma^1_u\phi^1_u)$, $^1\Sigma^+_g \rightarrow {}^{1,3}\Delta_g(\sigma^1_u\phi^1_u)$, $^1\Sigma^+_g \rightarrow {}^{1,3}\Pi_u$, ${}^{1,3}\Phi_u(\pi^1_g\delta^1_u)$, $^1\Sigma^+_g \rightarrow {}^{1,3}\Delta_g$, ${}^{1,3}\Gamma_g(\pi^1_u\phi^1_u)$, and $^1\Sigma^+_g \rightarrow {}^{1,3}\Phi_g$, ${}^{1,3}\Pi_g(\pi^1_u\phi^1_u)$. All of these excitation energies fall in the region of the experimental absorption spectrum. (auth)

18315 CALCULATION OF THE STATIC POLARIZABILITY AND VAN DER WAALS CONSTANT FOR ATOMS IN EXCITED STATES. Gutman, I. I.; Shendrik, T. V. (Odessa Polytechnical Inst.). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 334-335(Feb 1975). (In Russian).

Precise lower evaluations were made for the static polarizability a and the Van der Waals constant C. The formulas obtained were applicable to the excited states of atoms (if a and C are averaged over the different values of the quantum number m). The values of a and C were given for the ground and excited states of atoms of the alkali metals and inert gases. (tr)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstracts 18379, 18453, and 18533.

18316 (COO-3274-18, pp 75-89) POSITRON DIFFUSION IN NOBLE GASES. Stromswold, D. C.; Lee, Y. K. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

Positron diffusion in helium, neon, and argon has been observed and the lifetimes of free positrons in these gases have been calculated on the basis of assumed theoretical behavior. The results are summarized for various gas pressures at room temperature. Reported lifetimes are comparable to the extrapolated values of 1.4 mu sec in He and 0.2 mu sec in Ar obtained at one atmosphere by Falk. (7 figures, 2 tables) (SDF)

18317 ELECTRON LIQUID IN COLLECTIVE DESCRIPTION. II. Application to Positron Annihilation. Arponen, J.; Pajanne, E. (Univ. of Helsinki). J. Phys., C (London); 8: No. 9, L152-L157(7 May 1975).

Positron annihilation is studied by using the boson description of the electron gas. The electron-electron interactions are taken in RPA, whereas the positron-electron interaction is more accurately treated. The scheme corresponds to calculating certain very large sets of perturbation diagrams. Results are given for the positron annihilation probability, the pair-correlation function, and the positron kinetic energy and chemical potential for various electron densities. This approach gives new insight into the nature of the low density divergencies occurring in many calculations of positron annihilation. (auth)

18318 INTERACTION OF POSITRONIUM WITH METAL (III) ACETYLACETONATO COMPLEXES IN BENZENE. Endo, K.; Furukawa, M.; Yamatera, H. (Nagoya Univ., Japan). Radiochem. Radioanal. Lett.; 21: No. 5, 307-311(24 May 1975).

Fast-slow coincidence circuits were constructed, which gave the resolution of 0.75 ns full-width at half maximum with the ^{60}Co prompt γ-rays. The mean lifetime of o-Ps in benzene was shortened by the Cr^{3+}, Mn^{3+} and Fe^{3+} complexes, while it was not affected by the Al^{3+} and Co^{3+} complexes. The mean lifetime of o-Ps was 3.20 ns in pure benzene and 3.95 ns in pure hexane. (auth)

18319 PROTON-STRUCTURE CORRECTION OF THE LAMB SHIFT. Gajzago, E. (Eotvos Lorand Univ., Budapest). Magy. Fiz. Foly.; 22: No. 4, 339-389(1974). (In Hungarian).

The Lamb shift in the spectrum of hydrogen, as formulated by Dirac, has been explained by quantum electrodynamic considerations. Various properties of the proton, e.g., its finite extension, electric and magnetic polarizability affect the H spectrum. The good agreement between the theoretical and experimental data on the Lamb shift indicate that the dynamic properties of the proton have only a slight effect. This question and the contribution of the polarizability of hydrogen-like atoms, such as muon-hydrogen, were examined in the study. Because of its larger mass and smaller Bohr radius, the muon-hydrogen was expected to be more sensitive toward such effects. After an historical review of the problem, the contribution of the polarizability was calculated, the Bethe-Salpeter equation was examined, presenting experimental data on inelastic electron-proton scattering events and their relation with the electric and magnetic polarizability of the proton. On the basis of a concrete model, it was attempted to evaluate the anomalies in the muon-hydrogen spectrum caused by anomalous muon-hydrogen interactions. (Doctoral dissertation). (TTT)

18320 POSITRON ANNIHILATION IN TRANSITION METALS. Nakao, Y. (Aoyama Gakuin Univ., Tokyo (Japan)). Appl. Phys.; 7: No. 1, 81-82(May 1975).

From 3rd international conference on positron annihilation; Otaniemi, Finland (7 Aug 1973). 3 figs.; 4 refs.

The positron annihilation rate in a ferromagnetic electron system which is described by a generalized Anderson model was studied. Because of the spin polarization of s-type electrons, the difference in the annihilation rate between the majority and the minority spins changes its sign at the momentum corresponding to the virtual d-level. The enhancement factor due to the effective Coulomb interaction between the electrons and a positron was calculated using the dielectric constant for a ferromagnetic electron gas derived by Kim and Schwartz. (auth)

18321 ON POSITRON ANNIHILATION IN ZINC. Kontrym-Sznajd, G.; Stachowiak, H. (Polska Akademia Nauk, Wroclaw. Instytut Niskich Temperatur i Badan Strukturalnych). Appl. Phys.; 5: No. 4, 361-365(Jan 1975).

From 3rd international conference on positron annihilation; Otaniemi, Finland (7 Aug 1973). 4 figs.; 11 refs.

An attempt is made to understand Mogensen's and Petersen's positron annihilation curves for zinc. Mijnarends approach is used as an auxiliary method of localizing inhomogeneities of the electronic density in momentum space, as defined in the paper. Evidence is found for a new effect consisting of a strong enhancement of the annihilation probability in the lenses obtained by the intersection of the Fermi surface with HMC surfaces. This effect, not the anisotropy of the Fermi surface, is the main reason for the anisotropy of the annihilation curves. (auth)

18322 THE MUONIC X-RAY CASCADE IN FLUORINE FOLLOWING THE μ-TRANSFER FROM HYDROGEN. Holzwarth, G.; Pfeiffer, H. J. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Department). Z. Phys., A; 272: No. 3, 311-313(Mar 1975).

The x-ray cascade following the μ-transfer reaction $\mu p + F \rightarrow p + \mu F$ is interpreted in terms of a pseudolevel crossing model which predicts the angular momentum distribution of the n = 6 level essentially populated by the transfer. The resulting cascade agrees with recent experimental results. (auth)

18323 FINE-STRUCTURE MEASUREMENT IN THE FIRST EXCITED STATE OF POSITRONIUM. Mills, A.P. Jr.; Berko, S.; Canter, K.F. (Department of Physics, Brandeis University, Waltham,

Massachusetts 02154). Phys. Rev. Lett. 34: No. 25, 1541-1544 (23 June 1975).

The $2^3S_1-2^3P_2$ energy splitting of positronium has been observed by inducing rf transitions in a weak magnetic field ($\simeq$50 *G*) in the absence of a buffer gas and observing a resonant increase in the Lyman-α emission. We obtain 8628.4±2.8 MHz, which is within 2 standard deviations of the theoretical value computed to order α^3R by Fulton and Martin. (auth)

Collision Phenomena

Refer also to abstracts 18292 and 18311.

18324 (BNWL-1950(Pt.4), pp 47-59) RADIATION PHYSICS. Feb 1975.

In Pacific Northwest Laboratory annual report for 1974 to the USAEC Division of Biomedical and Environmental Research. Part IV. Physical and analytical sciences.

Electron emission from molecules bombarded by protons is studied to provide information on primary collision processes. This information is then used to formulate descriptions of track structure and the interaction of ionizing tracks with volumes of biological and biochemical importance. Finally, mechanisms of energy transport and transformation from the energetic initial processes into chemical species is studied. Electron emission cross section measurements have been extended to lower energies and to more complex molecules, and measured cross sections have been compared with various theoretical calculations for electron energies from 0.5 eV. Cross sections are used to facilitate introduction of these data into track structure codes. Track structure parameters are incorporated, as initial conditions, into kinetic models describing fluorescence life time and nonlinear decay of proton excitation in the condensed phase. (auth)

18325 (COO-2326-10) TOTAL SCATTERING CROSS SECTIONS CALCULATED FROM NONSCATTERING INFORMATION. Stwalley, W. C.; Togeas, J. B.; Way, K. R.; Li, K. C.; Proctor, T. R. (Iowa Univ., Iowa City (USA). Dept. of Chemistry). 1975. 3p. (CONF-750705-1). Dep. NTIS $4.00.

From 9th international conference on physics of electronic and atomic collisions; Seattle, Washington, USA (24 Jul 1975).

Potentials have been constructed from nonscattering information and cross sections have been calculated for the reactions H + Hg, H + Li, He(2^{1}S) + He, and Mg + Mg. The potentials in each case are based primarily on spectroscopic information. (2 figures) (SDF)

18326 (ORNL-tr-2952) SUCCESSIVE IONIZATION OF POSITIVE IONS OF CARBON AND NITROGEN BY ELECTRON BOMBARDMENT. Donets, E. D.; Ilyushchenko, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. (CONF-740233-2). 26p. Dep. NTIS $4.50.

From session of the Division of Nuclear Physics of the Academy of Science; Dubna, USSR (11 Feb 1974).

Experimental studies of deep ionization of heavy ions are described. The applications of such studies in atomic physics, plasma physics and space physics are discussed. Investigations using intersecting ion-electron beams, shifted beams and ion trap sources are described, and data are presented for multi-charged ions of carbon, oxygen and nitrogen. A detailed description of the development of the IEL (electron beam ionizer) source, and the KRION (cryogenic version) source is given, and further data for the multiple ionization of carbon and nitrogen are given for charge states up to C^{6+} and N^{7+}. The advantages and disadvantages of the KRION source are discussed, and preliminary studies of a new torroidal ion trap source (HIRAC) are presented. (11 figs., 57 refs.) (auth)

18327 (ORO-3398-45, pp 44-45) CROSS SECTIONS FOR X-RAY PRODUCTION BY HIGH ENERGY ALPHA PARTICLES. Hardt, T. L.; Watson, R. L. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Experiments have been carried out to determine the K shell ionization cross sections for a wide range of elements using alpha particles in the energy range 30 to 80 MeV. The most recent set includes the elements Te, Ba, Nd, Gd, Tm, Ta, Au, and Pb. Results have been compared with Born approximation calculations, and previous data is compared with binary encounter model predictions. (3 figures) (SDF)

18328 (ORO-3398-45, pp 46-47) SECONDARY X-RAY PRODUCTION BY DELTA RAYS AND BREMSSTRAHLUNG. Hardt, T. L.; Strack, D. S.; Howard, R. W.; Sutton, S.; Lewis, C. W.; Watson, R. L. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Delta ray K x-ray production cross sections associated with alpha particle bombardments of Fe, Ni, Cu, Zr, Nb, Rh, Pb, Ag, and Sn have been calculated. The related problem of background associated with charged particle induced x-ray emission has also been considered. Experiments were carried out to determine relative magnitudes of direct bremsstrahlung emission and secondary bremsstrahlung generated by delta rays. The direct contribution appears to be negligible at angles greater than approximately 60 degrees. (3 figures, 1 table) (SDF)

18329 (ORO-3398-45, pp 48-49) MULTIPLE IONIZATION EFFECTS IN X-RAY EMISSION INDUCED BY ALPHA PARTICLES. Watson, R. L.; Li, T. K.; Hansen, J. S. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Experiments have been performed in which level matching effects have been observed for simple and fully stripped projectiles. The measurements compared the k/sub alpha/ to k/sub beta/ x ray intensity ratios obtained in alpha particles bombardment with those of deuterons of the same velocity incident on the same targets. Results are presented for projectile energies of 6.25, 2.88, and 2.35 MeV/amu. (2 figures) (SDF)

18330 COUPLED STATE CALCULATION OF PROTON HYDROGEN COLLISIONS IN A GAUSSIAN BASIS. Dose, V. (Univ., Wuerzburg, Ger.); Semini, C. Helv. Phys. Acta; 47: 609-621 (1974).

Proton–hydrogen scattering has been used to investigate the usefulness of Gaussian functions as a basis set for the description of atomic collisions. An impact-parameter close-coupling calculation is carried out and cross-sections for ground-state electron capture, total electron capture and free electron production are obtained. Generally, promising agreement of the results of this work with other theoretical and experimental investigations is observed. (7 figs, 18 refs) (auth)

18331 STURMIAN BASIS FUNCTIONS IN THE COUPLED STATE IMPACT PARAMETER METHOD FOR H^+ + H SCATTERING. Shakeshaft, R. (New York Univ., NY). J. Phys., B (London); 8: No. 7, 1114-1128(11 May 1975).

When Sturmian basis functions are used in the standard coupled state impact parameter method for proton–hydrogen atom scattering, the correct boundary conditions cannot, in general, be satisfied. This means that for most choices of the initial and final states the approximate transition amplitude, as usually defined, does not exist. The present paper resolves this difficulty, and an approximate transition amplitude is defined which is a variational estimate of the exact transition amplitude for arbitrary initial and final states. It is also shown that in the Sturmian representation the exchange matrix elements can be calculated more directly by solving a set of coupled differential equations which is somewhat different from the set of equations given by Cheshire (Proc. Phys. Soc.; 92: 862-5 (1967)). A procedure that does not require storage and interpolation of the matrix elements in order to exploit their time-symmetry is also described. As a simple numerical test of the methods outlined in this paper, the coupled state equations have been solved for an energy of 25 keV and an impact parameter of 1 au with the inclusion of up to ten Sturmian s-states. The results are fairly encouraging. (auth)

18332 USE OF SECOND-ORDER POTENTIALS IN THE THEORY OF SCATTERING OF CHARGED PARTICLES BY ATOMS. VIII. The Excitation of the n = 3 Levels of Helium by Electron and Proton Impact. Bransden, B. H.; Issa, M. R. (Durham Univ., Eng.). J. Phys., B (London); 8: No. 7, 1088-1094(11 May 1975).

Cross sections for the excitation of helium from the ground state to the 3^1S, 3^1P and 3^1D levels, by electrons with energies in the range 100 to 1000 eV, and by protons with energies in the range 50 to 1000 keV, have been calculated in a distorted wave approximation. The wavefunction in the incident channel was taken from a previous calculation employing a second-order effective potential, and in the final state the effect of coupling between the n = 3 levels was included. In the case of excitation of the 3^1D level, it is shown that transitions via the 2^1P intermediate state are important over the whole range. The calculated values are compared with those obtained from experiment, and generally satisfactory agreement is found. (auth)

18333 e-H^- ELASTIC SCATTERING IN EIKONAL APPROXIMATION. Kumar, S.; Tripathi, A. N.; Srivastava, M. K. (Roorkee Univ., India). J. Phys., B (London); 8: No. 7, 1082-1087(11 May 1975).

The recently proposed procedure of electron–ion elastic scattering in the eikonal approximation is used to calculate e-H^- elastic scattering cross sections. It is found that the main features of the results of McDowell (Phys. Rev.; 175: 189-196(1968)) can

be reproduced substantially by this method, which is relatively very easy. (auth)

18334 ELECTRON IMPACT EXCITATION OF H AND He^+. IV. Orientation and Alignment of the 2p State. Morgan, L. A. (Royal Holloway Coll., Englefield Green, Eng.); McDowell, M. R. C. J. Phys., B (London); 8: No. 7, 1073-1081(11 May 1975).

Orientation and alignment effects observable in coincidence measurements of Ly α photons and scattered electrons are discussed. Results, in the DPWO II model, are presented for the Fano–Macek parameters. Computer generated maps of the coincidence rate as a function of scattering electron angle and photon emission angle are presented at two energies, and show interesting, energy-dependent symmetries. (auth)

18335 ELECTRON IMPACT EXCITATION OF H AND He^+. III. 1s → np Transitions. McDowell, M. R. C. (Royal Holloway Coll., Englefield Green, Eng.); Morgan, L. A.; Myerscough, V. P. J. Phys., B (London); 8: No. 7, 1053-1072(11 May 1975).

The distorted wave polarized orbital models described previously (McDowell et al. J. Phys. B. Atom. Molec. Phys.; 6: 1435-51(1973) and 7: L195-7 (1974)) are used to calculate total and differential cross sections for 1s → np (n = 2, 3, 4) transitions in H and He^+. The calculated total 2p cross sections agree with experiment within ±10% at all energies above 20 eV. Differential cross sections for total n = 2 excitation are in good agreement with experiment at 50 eV and angles below 60°. The predictions for 90° polarization of Ly α also agree closely with experiment for E > 20 eV. (auth)

18336 ION PAIR PRODUCTION IN THE COLLISIONAL DISSOCIATION OF H_2. Brouillard, F.; Claeys, W.; Delfosse, J. M. (de Physique Corpusculaire, Louvain-La-Neuve, Belgium). J. Phys., B (London); 8: No. 7, 1149-1159(11 May 1975).

This paper is concerned with an experimental study of the ion pair production in the dissociation of molecules induced by collision with heavy particles at relative velocities of the order of 10^8 cm s^{-1}. The investigation consists of measurements of cross sections, energy and angular distributions of the fragments. The apparatus and the experimental method are fully described. Results are reported for the ion pair production from 6 keV H_2 molecules impinging on He, Ne and Xe: $H_2 + X \rightarrow H^+ + H^-(+ X)$. (auth)

18337 POTENTIAL SURFACE DEPENDENCE OF CROSS SECTIONS AND RATE CONSTANTS FOR THE VIBRATIONAL RELAXATION OF H_2 IN COLLISIONS WITH ^4He. Alexander, M. H. (Maryland Univ., College Park (USA). Dept. of Chemistry). Chem. Phys.; 8: No. 1, 86-98(Apr 1975).

Within the Rabitz effective potential formalism, fully-converged quantum calculations of ro-vibrationally inelastic cross sections for collisions of He with o-H_2 and p-H_2 have been performed. Three different interaction potentials were used, each of which represents a different analytic fit to the Krauss-Mies or Gordon-Secrest ab initio potential surfaces. Although the calculated cross sections exhibit the same qualitative features, the quantitative agreement is no better than a factor of five. Vibrationally inelastic processes appear to be extremely sensitive to the specific choice of potential surface. The de-excitation cross sections satisfy a power-law dependence on the initial relative translational energy. Exploiting this fact, temperature dependent rate constants have been determined. Based on the two-state model, relaxation times are determined and compared with recent experimental results. Qualitative agreement occurs for $300 \lesssim T < 600$ K. At lower temperatures the experimental relaxation times level off significantly, presumably reflecting long-range interactions which are not present in the potential surfaces. At high temperatures ($1300 \leq T \leq 3000$ K) the theoretical relaxation times decrease faster with increasing temperature than do the experimental values. Possibly this discrepancy arises from difficulties in the interpretation of an experimental relaxation time in a regime where many rotational levels are contributing to overall vibrational relaxation. (auth)

18338 HEAVY ION SCATTERING BY A CRYSTAL. Skripka, Yu. G.; Trynkina, O. M.; Trynkin, A. P. (Donetsk Main Univ., USSR). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 3, 256-258 (Mar 1975). (In Ukrainian).

The ion scattering by surface atomic rows of the crystal are studied. The results of the computation of ion scattering by atomic chains are presented. (auth)

18339 CORRECTED CLOSURE APPROXIMATION FOR THE CALCULATION OF ELECTRON LOSS FROM FAST HYDROGEN ATOMS PASSING THROUGH ATOMIC HYDROGEN. Belkic, D. (Institut za Fiziku, Belgrade); Gayet, R. J. Phys., B (London); 8: No. 3, 442-447(21 Feb 1975).

Electron loss from hydrogen atoms passing through atomic hydrogen is calculated in the Born approximation. Contribution of all open channels is taken into account by means of the closure approximation and corrections are introduced for the final states 1s, 2s and 2p of the target atom. It is shown that the procedure called "corrected closure approximation" converges rapidly. Attention is drawn to the possibility of obtaining a close upper bound to the Born cross section. Excellent agreement with experimental data is obtained for impact energies beyond 50 keV, that is in the region where the Born approximation is expected to be successful. (auth)

18340 CALCULATION OF THE INTERACTION BETWEEN PAIRS OF RARE-GAS ATOMS. Rae, A. I. M. (Univ. of Birmingham, Eng.). Mol. Phys.; 29: No. 2, 467-483(Feb 1975).

A recent theory of intermolecular forces is modified by the exclusion of part of the previously estimated exchange energy and the inclusion of the long-range dispersive interaction. This procedure is justified by comparison with the theory of plasma oscillations. Results have been obtained which are in good agreement with experiment in the case of He-He, Ne-Ne, Ar-Ar and Kr-Kr interactions and are in reasonable accord in the case of the unlike-atom pairs. (auth)

18341 CALCULATIONS OF ION–ATOM DIFFERENTIAL SCATTERING CROSS SECTIONS USING INVERSE POWER POTENTIAL. Ghosal, S. N.; Das, M. (Presidency Coll., Calcutta). Indian J. Phys.; 48: No. 11, 968-972(Nov 1974).

The method of calculation of differential cross sections is extended, considering up to second order terms in the Mott-Smith expansion. Comparison with experimental data, when the form of the interaction potential is accurately known, shows better agreement than do cross sections calculated from a first order Mott-Smith formula. (1 fig.) (GHT)

18342 GLAUBER EXCHANGE AMPLITUDES. Madan, R.N. (Department of Physics, North Carolina A & T State University, Greensboro, North Carolina 27411). Phys. Rev. A 11: No. 6, 1968-1972 (June 1975).

The extrapolation method of Ochkur, valid for intermediate energies (~50 eV), is applied to the exchange form of the Glauber amplitudes. In the case of elastic scattering of electrons from hydrogen atoms at 54.4 eV the "post" and "prior" forms of the exchange amplitude are equivalent, whereas for the case of inelastic scattering there is a minute discrepancy between the two forms of the amplitude. The results are compared with the close-coupling calculation. The investigation is expected to be useful for optically forbidden exchange-allowed transitions due to electron impact at intermediate energies. (auth)

18343 VARIABLE-SCREENING MODEL FOR THE QUASIMOLECULAR TREATMENT OF ION-ATOM COLLISIONS. Eichler, J.; Wille, U. (Hahn-Meitner-Institut für Kernforschung Berlin GmbH, Bereich Kern- und Strahlenphysik, Berlin, West Germany Phys. Rev. A 11: No. 6, 1973-1982 (June 1975).

An effective single-electron potential is proposed which is appropriate for a realistic description of the electronic motion in quasimolecular systems formed in near-adiabatic ion-atom collisions. The potential is represented as a sum of two spherical potentials, each centered about one of the colliding nuclei. For finite internuclear distances, these potentials are obtained by smoothly interpolating the screening parameters of suitable *atomic potentials* (Thomas-Fermi or phenomenological potentials) between the united-atom and separated-atom limits ("variable-screening model"). The use of phenomenological potentials entails a great accuracy in describing the atomic states and opens up the possibility of treating ionized quasimolecular systems which were hitherto inaccessible to molecular-orbital Hartree-Fock calculations. Molecular correlation diagrams calculated from the variable-screening model for various neutral and ionized systems are presented. For the neutral cases the agreement with the results of Hartree-Fock calculations is surprisingly good. The scaling properties of the variable-screening model are discussed. (auth)

18344 DISSOCIATIVE RECOMBINATION OF ELECTRONS AND D_2^+ TO YIELD D(2*p*). Vogler, M.; Dunn, G.H. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards, Boulder, Colorado 80302). Phys. Rev. A 11: No. 6, 1983-1987 (June 1975).

Cross sections have been measured as a function of electron energy (1.4 to 7.5 eV) for production of L_α photons from the dissociative recombination of electrons and D_2^+. Ions made in a low-pressure ion source by electron bombardment and formed into a beam are reacted at right angles with a magnetically confined electron beam. Recombination was observed by detecting L_α photons from resultant excited atoms. It was demonstrated that a large fraction of the observed light arises from cascade to the 2*p* state from levels of higher principal quantum number. The measured cross section is thus presented as an upper limit for formation of D(2*p*) in the dissociative recombination process. The results, represented approximately by the expression $\sigma(2p) < (7.6 \times 10^{-17}) E^{-1.25}$ cm², indicate that recombinations leading to formation of a D(2*p*) are a small fraction of the total recombination measured by Peart and Dolder. (auth)

18345 SEMIEMPIRICAL MODEL FOR ANGULAR DISTRIBUTION OF ELECTRONS EMITTED IN METASTABLE ATOM-ATOM COLLISIONS. Micha, D.A.; Nakamura, H. (Quantum Theory Project, Departments of Chemistry and Physics, University of Florida, Gainesville, Florida 32611). Phys. Rev. A 11: No. 6, 1988-1993 (June 1975).

Electron angular distributions from ionization in collisions of He($2\,^{1,3}S$) and Ar(^1S) have been studied in terms of molecular-orbital correlation diagrams and a semiclassical and probabilistic model for the collision process. Consideration of the united-atom limit for this system indicates that the electronic angular momenta $\lambda = 0,1$, and 2 play an important role. The interaction potential responsible for electron emission was assumed to decrease exponentially with increasing distance, and was parametrized by fitting experimental results at a fixed collision energy. The values of the parameters show that $\lambda = 0$ is the dominant partial wave and lead to backward-peaked distributions. Calculations performed at other energies show an increasing anisotropy with increasing collision energies. (auth)

18346 INTERACTIONS OF EXCITED ($n = 3$) AND GROUND-STATE HELIUM ATOMS: POTENTIAL CURVES AND INELASTIC PROCESSES. Steets, W.J.; Lane, N.F. (Physics Department, Rice University, Houston, Texas 77001). Phys. Rev. A 11: No. 6, 1994-2003 (June 1975).

Adiabatic potential-energy curves have been calculated for the interaction of several $n = 3$ triplet states of helium with ground-state helium. Mechanisms for excitation-transfer in collisions of $3\,^3S$ and $3\,^3P$ with ground-state atoms are suggested by the results of these calculations. A deexcitation cross section corresponding to $3\,^3S \rightarrow 2\,^3P$ excitation-transfer has been calculated using the Stueckelberg-Landau-Zener approximation and is consistent with existing measurements. The existence of a small hump in the potential curve causes the cross section to decrease rapidly at low energies. Thus, a strong temperature dependence of effective cross sections is expected. A possible mechanism for associative ionization is also discussed. (auth)

18347 HARTREE-SLATER CALCULATION OF THE CROSS SECTION FOR *L*-SHELL IONIZATION OF ARGON BY SIMPLE HEAVY CHARGED PARTICLES. Choi, B. (University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514). Phys. Rev. A 11: No. 6, 2004-2010 (June 1975).

The cross sections for *L*-shell and subshell ionization by direct Coulomb excitation of argon by incident heavy charged particles are evaluated. Incident particles are described in the plane-wave Born approximation, and nonrelativistic Hartree-Slater (HS) wave functions are used for the atomic electrons. Form factors, energy distributions, and ionization cross sections are compared with those obtained from screened hydrogenic wave functions. At most incident energies, the HS results for the total ionization cross section are only slightly smaller than those obtained with screened hydrogenic wave functions, but considerable discrepancies are found for form factors and energy distributions near the ionization threshold. (auth)

18348 CHARGE TRANSFER IN PROTON-HELIUM COLLISIONS. Bhadra, K.; Ghosh, A.S.; Sil, N.C. (Department of Theoretical Physics, Indian Association for the Cultivation of Science, Calcutta-700032, India). Phys. Rev. A 11: No. 6 2011-2017 (June 1975).

An approximate integral form of the close-coupling formalism has been applied to the charge-transfer process in the proton-helium collision problem. Results for the ground-state capture cross section have been obtained with the inclusion of the effect of proton-nucleus interactions and compared with the available experimental and theoretical results. The present values of the capture cross section are in very good agreement with the experimental observations at high as well as intermediate incident energies. At low energies the nature of the experimental curve has been correctly reproduced. Results for the differential capture sections in the forward direction and the total elastic cross sections have also been reported. (auth)

18349 MAXIMA AND MINIMA IN THE ANGULAR DEPENDENCE OF THE $[np)(n+1)\,s]$ TRANSITION IN THE RARE GASES OBSERVED BY HIGH-ENERGY ELECTRON IMPACT SPECTROSCOPY. Wong, T.C.; Lee, J.S.; Bonham, R.A. (Department of Chemistry, Indiana University, Bloomington, Indiana 47401). Phys. Rev. A 11: No. 6, 1963-1967 (June 1975).

A minimum and a maximum in the generalized oscillator strength are observed as a function of momentum transfer for the $[np)(n+1)\,s]$ transition in Ne, Ar, Kr, and Xe using 25-keV incident electrons. The results indicate that the occurrence of these extrema is due to zeros in the first Born scattering amplitude, and the positions of the extrema are found to be in excellent agreement with available Hartree-Fock calculations. (auth)

18350 COLLISIONS BETWEEN RARE-GAS ATOMS AT LOW-keV ENERGIES. II. ASYMMETRIC COLLISION SYSTEMS: He-Ne, -Ar, -Kr, -Xe. Brenot, J.C.; Dhuicq, D.; Gauyacq, J.P.; Pommier, J.; Sidis, V.; Barat, M.; Pollack, E. (Laboratoire de Collisions Atomiques Bâtiment 220, Université Paris-Sud, 91405 Orsay, France). Phys. Rev. A 11: No. 6, 1933-1945 (June 1975).

Elastic and inelastic collisions in the asymmetric He-*X* (X = Ne, Ar, Kr, Xe) systems are studied at low-keV energies (0.8–3.0 keV). The experimental method involves energy-loss measurements on the scattered particles using either a time-of-flight technique (for neutrals) or electrostatic energy analysis (for ions). Differential cross sections are reported and the results interpreted in a quasimolecular treatment of the collision. Of particular significance is the very low excitation and ionization of the helium projectile relative to excitation of the target. An understanding of this requires a modification of the usual diabatic correlation rules, and implies the promotion of the outer filled molecular orbital. Predictions made from the modified correlation diagram, and calculated potential-energy curves are found to agree with the experimental results. (auth)

18351 CALCULATIONS OF ION-ATOM INTERACTIONS RELATING TO RESONANT CHARGE-TRANSFER COLLISIONS. Bardsley, J.N. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards, Boulder, Colorado 80302); Holstein, T.; Junker, B.R.; Sinha, S. Phys. Rev. A 11: No. 6, 1911-1920 (June 1975).

The interaction between an atom and ion of the same element leads to gerade and underade states of the diatomic molecular ion. The energy splittings between the gerade and ungerade states determine the cross section for resonant charge transfer. Using the JWKB approach these energy splittings are derived from the asymptotic forms of the wave functions for the isolated atom and ion. Pseudopotential calculations of the splittings are reported for Li_2^+, Na_2^+, Rb_2^+, and Cs_2^+, and are used together with previous *ab initio* and model-potential calculations to test the JWKB method. The comparison shows that the method is sufficiently reliable to facilitate accurate calculations of the cross sections for resonant charge transfer at low energies. (auth)

18352 ABSOLUTE MEASUREMENT OF TOTAL ELECTRON-IMPACT CROSS SECTIONS TO SINGLET AND TRIPLET LEVELS IN HELIUM. Showalter, J.G.; Kay, R.B. (The American University, Washington, D.C. 20016). Phys. Rev. A 11: No. 6, 1899-1910 (June 1975).

Absolute total apparent electron impact cross sections for excitation of helium $4\,^1S$, $5\,^1S$, $3\,^1P$, $4\,^1P$, $5\,^1P$, $3\,^1D$, $4\,^1D$, $5\,^1D$, $4\,^3S$, $3\,^3P$, $3\,^3D$, and $4\,^3D$ levels have been measured. The incident electron energies begin at 50 eV and extend to 500 eV for most levels studied and extend to 800 eV for the $3\,^1P$, $4\,^1S$, and $4\,^1D$ levels. The 1σ errors for most of the cross sections measured are $\pm 10\%$. The important $3\,^1P$ cross section is 15% below the Bethe approximation (Kim and Inokuti) at 200 eV and is within 6% of the Bethe approximation at 500 eV. The results are reported as polarization-corrected, apparent cross sections. Cascade-corrected cross sections are also given at selected energies. In addition the pressure dependencies of the apparent cross sections are presented for representative levels. Considerable attention is given to the description of the experimental apparatus, the treatment and analysis of the data, the techniques employed in absolute calibration, and the assessment of the errors in the experiment. (auth)

18353 TIP REGION OF THE BREMSSTRAHLUNG SPECTRUM FROM INCIDENT ELECTRONS OF KINETIC ENERGY 50 keV–1.84 MeV. Pratt, R.H.; Tseng, H.K. (Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. A 11: No. 6, 1797-1803 (June 1975).

Numerical calculations for the tip region of the electron bremsstrahlung spectrum are reported for incident electron kinetic energies in the range from 50 keV to 1.84 MeV. The calculations are exact within the framework of a single electron in a screened central potential and are obtained by summing integrals resulting from a partial-wave expansion of the wave functions. Results are compared with previous theoretical calculations and with experiments. For low energies the screening correction to the spectrum is generally not small. We find that for high-Z elements the discrepancies between theory and experiment reported by Starek, Aiginger, and Unfried are due to the use of inaccurate theoretical approximation. For low-Z elements the discrepancy remains. (auth)

18354 FORMATION AND DECAY OF Hg_2 EXCIMERS IN Hg-Ar MIXTURES. Siara, I.N.; Krause, L. (Department of Physics, University of Windsor, Windsor, Ontario, Canada). Phys. Rev. A 11: No. 6, 1810-1814 (June 1975).

The formation and decay of Hg_2 molecules in their $^3\Pi_u$ and $^3O_u^-$ states, produced in Hg-Ar mixtures irradiated with 2537-Å Hg resonance radiation, has been investigated by the method of delayed coincidences. The mixtures which consisted of Hg vapor at a pressure of about 1 Torr and Ar at pressures of 45–720 Torr and which were contained in a quartz fluorescence cell, were excited with pulses of light, and the decay spectra of the 3350- and 4850-Å molecular fluorescent bands were studied in relation to Ar pressure. Analysis of the decays indicates that the effective cross sections for $^3\Pi_u \rightarrow {}^3O_u^-$ mixing, induced in Hg_2-Ar collisions are of the same order as the Hg_2-N_2 mixing cross sections, leading to the conclusion that the

4850-Å band is emitted mainly by $^3O_u^-$ molecules in high vibrational states. (auth)

18355 INNER-SHELL EXCITATION-IONIZATION IN POTASSIUM BY ELECTRON IMPACT. Nygaard, K. J. (Univ. of Missouri, Rolla). Phys. Lett.; 51A: No. 3, 171-172(24 Feb 1975).

A new autoionization peak in potassium at 20 eV is attributed to excitation of the $3p^54s^2$-levels at 18.72 and 18.98-eV. Metastable ions contribute to the total ionization cross section for energies above 24.4 eV. (1 fig.) (auth)

18356 MOLECULAR MULTIPOLE MOMENTS DERIVED FROM COLLISIONAL QUENCHING OF H(2s). Dose, V.; Semini, C. (Univ., Wuerzburg, Ger.). Helv. Phys. Acta; 47: 623-629(1974).

Improvement on existing Born approximation treatments of collisional quenching of metastable hydrogen atoms by molecules in thermal energy collisions is attempted. A four-state coupled-channel impact parameter calculation is carried out. The molecule is treated as a static charge distribution whose rotational motion is neglected. Cross-section results from the present calculation are used to calculate new values of multipole moments for CH_3I, N_2, CO_2, and CCl_4 from available experimental data. (12 refs) (auth)

18357 TOTAL CROSS SECTIONS FOR THE SCATTERING OF 50 TO 400 eV POSITRONS BY HELIUM. Dutton, J.; Harris, F. M.; Jones, R. A. (University Coll. of Swansea, Eng.). J. Phys., B (London); 8: No. 5, L65-L69(1 Apr 1975).

A specially designed magnetic spectrometer has been used in experiments to determine total e^+-He scattering cross sections for positrons having energies between 50 and 400 eV. The results are in good agreement with calculated values but are larger than earlier experimental data. (auth)

18358 RADIATIVE DECAY OF AUTOIONIZED STATES OF POTASSIUM AND RUBIDIUM ATOMS. Bogachev, G. G. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 12, 2061-2062(Dec 1974). (In Russian).

A study was made of the spectra of K and Rb atoms, which were excited by electron collision, in the regions of 550 to 800 Å and 650 to 900 Å respectively. Most of the lines are related to ionic transitions. The previously unknown lines of 720 and 752 Å for potassium and 824 Å for rubidium were assigned to radiative transitions from levels $3p^54s\ p^4L$, $3p^54s5p^4L'$ and $4p^55s5p^4L''$ respectively to the lower levels of the main K and Rb series, which were caused by excitation of the valence s-electrons. (SJR)

18359 VIBRATION-TO-VIBRATION ENERGY TRANSFER OF CO IN THE STATES OF V = 2-9. Fushiki, Y.; Tsuchiya, S. (Tokyo Univ. (Japan). Coll. of General Education). Jap. J. Appl. Phys.; 13: No. 7, 1043-1049(Jul 1974).

A phase-shift method was applied to measure the V-V relaxation rate of CO excited up to $\nu = 9$ by a collision with $Hg(6^3P_1$ or $^3P_0)$, which is formed through the Hg-resonant radiation modulated at frequencies in the range of 0.12 to 1.4 kHz. If it is assumed that the collisional transition is limited to $\nu \rightarrow \nu - 1$ and that a large excess of ground state CO exists in the system, the relaxation rate may be determined from the ac component of the population in each level without any knowledge of the initial vibrational distribution. The observed rates of the V-V relaxation, $CO(\nu) + CO(0) \rightarrow CO(\nu - 1) + CO(1)$, are 6.2, 8.4, 10.1, 6.4, 3.2, 1.5, 0.74 and 0.53×10^4 $Torr^{-1}sec^{-1}$ for excited CO in respective levels of $\nu = 2 \sim 9$. (auth)

18360 COMPUTER SIMULATION OF ATOMIC MIXING DURING ION BOMBARDMENT. Ishitani, T.; Shimizu, R. (Osaka Univ., Suita (Japan). Dept. of Applied Physics). Appl. Phys.; 6: No. 2, 241-248(Mar 1975).

The atomic mixing in the target under ion bombardment is assumed to result from cascades of atomic collision events. Computer simulations have been applied to collision cascades to estimate the depth resolution of surface analysis with an ion probe. The Monte Carlo method based on a single scattering model has been used mainly in the calculation under the assumptions of random collision process, no diffusion, and no target saturation processes. High-energy collisions are characterized by a Lenz-Jensen or a Thomas-Fermi potential, while a Born-Mayer potential is used in the low energy region. The simulations have been performed for the bombardment of Ar ions with $E_0 = 5$ keV and 10 keV at angles of incidence theta = 9° and 60° on Si targets. The depth resolutions are about 140 Å for the Lenz-Jensen cross section and about 80 Å for the Thomas-Fermi one for theta = 0° at $E_0 = 5$ keV, and a decrease by 20 to 40% at theta = 60° and increase by 70 to 90% for $E_0 = 10$ keV. (auth)

18361 THE VIBRONIC REPRESENTATION FOR COLLINEAR ATOM-DIATOM COLLISIONS: TWO-STATE SEMICLASSICAL MODEL. Laing, J.R.; George, T.F.; Zimmerman, I.H.; Lin, Y. (Department of Chemistry, The University of Rochester, Rochester, New York 14627). J. Chem. Phys. 63: No. 2, 842-851 (15 July 1975).

A unique semiclassical description of atom–diatom collisions is presented in which the vibrational as well as the electronic motion is treated quantum mechanically. The electronic Hamiltonian and the vibrational nuclear kinetic energy operator are diagonalized to yield vibronic potential energy curves, each correlating asymptotically to a specific electronic and vibrational state of the colliding species. The vibronic curves are used in Stueckelberg-like calculations to yield individual *S*-matrix elements. This theory is applied to a collinear nonreactive model of $X+H_2$ collisions in which X is either F or Br. *S*-matrix elements are calculated for transitions between the $^2P_{3/2}$ and $^2P_{1/2}$ spin–orbit states of the halogen and vibrational states of H_2. The results are in very good agreement with rigorous quantum results. (auth)

18362 ELECTRON-IMPACT EXCITATION OF H_2O AND D_2O AT VARIOUS SCATTERING ANGLES AND IMPACT ENERGIES IN THE ENERGY-LOSS RANGE 4.2–12 eV. Chutjian, A.; Hall, R.I.; Trajmar, S. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91103). J. Chem. Phys. 63: No. 2, 892-898 (15 July 1975).

The electron-impact excitation of H_2O and D_2O has been studied at electron energies close to threshold and at large scattering angles in order to enhance spin and/or symmetry forbidden electronic transitions; and at energies far from threshold and at small scattering angles to enhance optically allowed transitions. The energy-loss range covered is 4.2–12 eV. From a comparison of the present measurements and recent, accurate *ab initio* calculations, several new assignments of electronic transitions in both H_2O and D_2O have been made or suggested. Also suggested are future works which could be carried out in order to unravel the complex Rydberg spectra above 11 eV. (auth)

18363 THE VELOCITY DEPENDENCE OF THE EXCITATION TRANSFER REACTION $Ar(^3P_{2,0}) + N_2(X\,^1\Sigma^+_g) \rightarrow Ar(^1S) + N_2(C\,^3\Pi_u)$. Lee, W.; Martin, R.M. (Department of Chemistry, University of California, Santa Barbara, California 93106). J. Chem. Phys. 63: No. 2, 962-968 (15 July 1975).

The velocity dependence of the title reaction was determined using crossed effusive molecular beams with one beam time-of-flight velocity selected. The basis of the method is discussed, and the resolution is derived in terms of the experimental parameters. The velocity dependence was determined over the range 390–1630 m/s, corresponding to 0.013–0.226 eV relative energy. The cross section rises rapidly to 0.10 eV above which it is nearly constant to 0.226 eV. The thermal rate constant temperature dependence is calculated from the cross section energy dependence and normalized to the literature value for the rate constant at 300 °K. The cross section function over the energy range studied accounts for — 90% of the rate constant over the temperature range 78–600 °K. The activation energy is calculated over the range 50–700 °K from the cross section function and compared with the threshold energy E_0. Comparison of the present work with previous studies of the total quenching of $Ar(^3P_{2,0})$ by N_2 indicates that the cross sections for formation of $N_2(B\,^3\Pi_g)$ and $N_2(C\,^3\Pi_u)$ have a similar energy dependence below 0.05 eV. If these two states are formed *via* a common complex as previously proposed, this similarity suggests that the dependence on energy is primarily that for complex formation rather than for the subsequent partitioning into $N_2(B)$ and $N_2(C) + Ar(^1S)$ products. (auth)

18364 REACTIVE AND NONREACTIVE MODES OF ELECTRONIC EXCITATION AND MOLECULAR DISSOCIATION IN HYPERTHERMAL COLLISIONS OF ALKALI ATOMS WITH ALKALI HALIDES. Neoh, S.K.; Herschbach, D.R. (Department of Chemistry, Harvard University, Cambridge, Massachusetts 02138). J. Chem. Phys. 63: No. 2, 1030-1032 (15 July 1975).

A molecular beam study of translational-to-electronic energy transfer in collisions of hyperthermal K or Rb atoms with thermal alkali halide molecules is reported. Data are presented for the chemiluminescence cross sections for the Tb–NaI system. (AIP)

18365 THREE-DIMENSIONAL NATURAL COORDINATE ASYMMETRIC TOP THEORY OF REACTIONS: APPLICATION TO $H + H_2$. Elkowitz, A.B. (Department of Physics, University of Texas at Austin, Austin, Texas 78712); Wyatt, R.E. J. Chem. Phys. 63: No. 2, 702-721 (15 July 1975).

A particular partitioning of the Hamiltonian in natural collision coordinates is shown to lead to the use of hindered asymmetric top basis functions to represent all rotational motion (triangle tumbling plus internal bending) during reaction. These functions (along with perturbed Morse oscillator functions) are used as an adiabatic basis for expansion of the scattering wavefunction. The theory is discussed for both one and two reaction path potentials. The close coupled equations for the translational wavefunctions are then solved for the $H + H_2$ reaction at total angular momentum $J = 0$. Wavefunction bifurcation and matching at the reactant–product boundary surface is considered in detail. Finally, numerical results (reaction probabilities, probability conservation, detailed

balance, energy dependence of reactive *S*-matrix elements, probability density, wavefunction real part, and flux) are presented and comparisons are made with other quantum mechanical, semiclassical, and statistical reaction studies. (auth)

18366 MEASUREMENT OF THE ELECTRON IMPACT IONIZATION CROSS SECTION OF ATOMIC HYDROGEN IN THE METASTABLE 2S STATE. Dixon, A. J.; von Engel, A.; Harrison, M. F. A. (Oxford Univ.). Proc. R. Soc. (London), Ser. A; 343: No. 1634, 333-349(13 May 1975).

The total ionization cross section for electrons colliding with metastable 2S atoms has been measured up to 500 eV electron energy by a crossed beam technique. The results show that as the electron energy is raised, the ionization cross section for 2S atoms rises to a maximum at about 4 times the ionization energy of the 2S state. This maximum, about 10^{-15} cm^2, is 13 times larger than that of the 1S atoms. Comparison with various theoretical determinations indicates that best agreement is obtained with the Born approximation which includes exchange, but below 100 eV the classical Monte Carlo approximation agrees equally well with observations. (auth)

18367 ELECTRON IMPACT EFFECTIVE EXCITATION CROSS SECTIONS FOR GALLIUM. Shimon, L. L.; Neplipov, E. I.; Goldovskii, V. L.; Golovchak, N. V. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 233-237 (Feb 1975). (In Russian).

Excitation cross-sections for ten spectral lines were measured for the sharp and diffuse series of the gallium atom. Five lines corresponding to the excitation of 4s-electrons, and four lines in the case of a simple gallium ion were measured in spectral region from 2000 to 4200 Å. The differences between the excitation functions of lines from initial levels and transitions from higher ($n^2S_{1/2}$, $n^2D_{3/2}$, $n^2{}_{1/2,3/2}$) levels were studied. It is stated that there are additional maximum the excitation functions of lines in the case of 4p-electron excitation, and that excitation functions of the 4s-electron are of a resonance character, and finally, that the maximum of the excitation for ion lines is shifted, in comparison with that of atom lines, to the high energy range. (auth)

18368 ELECTRON IMPACT EXCITATION OF ALUMINUM ATOMS. Shimon, L. L.; Neplipov, E. I.; Zapesochnyi, I. P. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 2, 229-232(Feb 1975). (In Russian).

Using intersecting atomic and electron beams, the absolute excitation functions of aluminium atom spectral lines were measured. They correspond to transitions from lowest $4^2S_{1/2}$, $3^2D_{3/2}$ and $3^2D_{5/2}$ excited levels. We observe a difference between excitation of lines that originated from $4^2S_{1/2}$ or 3^2D_j levels as well as a difference in excitation of these levels in comparison with those in the case of heavier elements of the aluminium group. (auth)

Atomic Theory

Refer also to abstract 18296.

18369 CALCULATION OF IONIZATION ENERGIES AND LEVELS OF MULTIPLY CHARGED IONS WITH A THOMAS–FERMI CENTRAL POTENTIAL. Stepanov, K. L. Opt. Spectrosc.; 38: No. 1, 1-3(Jan 1975).

Translated from Opt. Spectrosk.; 38: No. 1, 3-8(Jan 1975).

By using a Thomas–Fermi statistical potential, one-electron energy levels and ionization potentials of multiply charged ions were determined for a broad range of atomic numbers and degrees of ionization. Results of the calculations were compared with experimental data, and were observed to be in satisfactory agreement. (3 figures, 2 tables) (auth)

18370 ATOMNAYA FIZIKA. Tom Vtoroi. Osnovy Kvantovnoi Mekhaniki i Stroenie Elektronnoi Obolochki Atoma. (Atomic Physics. Volume 2. Principles of Quantum Mechanics and Structure of the Electron Shell of the Atom). Shpol'skii, E. V. Moscow; Izdatel'stvo Nauka (1974). 448p.

This revised 4th edition (3rd edition was issued in 1951) has been considerably rewritten and reedited to present the basic principles of quantum mechanics in the symbolic form of an abstract algebra. From this formulation which is associated with the name of Dirac, matrix and also wave mechanics follow in an elegant fashion just as concrete concepts answering to various systems of coordinates flow from a general vector formulation in geometry. This type of deductive presentation of the principles of quantum mechanics is used extensively. (SJR)

18371 MODERN ATOMIC PHYSICS: FUNDAMENTAL PRINCIPLES. Cagnac, B.; Pebay-Peyroula, J. C. New York; John Wiley and Sons, Inc. (1975). 350p. $16.95.

The discussion of the fundamental principles of modern atomic physics includes waves and photons, the planetary model and the principle quantum number, and angular momentum and the magnetic moment. (JFP)

18372 MODERN ATOMIC PHYSICS: QUANTUM THEORY AND ITS APPLICATIONS. Cagnac, B.; Pebay-Peyroula, J. C. Macmillan Physics Text. New York; John Wiley and Sons, Inc. (1975). 270p. $17.95.

The discussion of modern atomic physics covers the quantum treatment of a single electron without spin in a central potential, independent electron approximation in a central potential for electronic configurations, angular momenta and enumeration of the energy levels, the spectroscopy of systems with one and two electrons, the Zeeman and Paschen-Back effects for atomic magnetism, the nucleus and the physics of the atom, and experimental methods in atomic physics. (JFP)

18373 EXTENSION OF GAUSSIAN70 TO ANY NUMBER OF ATOMIC ORBITALS. Carlson, G. L.; Pedersen, L. G. (Univ. of North Carolina, Chapel Hill). J. Comput. Phys.; 17: No. 4, 415-419(Apr 1975).

A general method for the extension of GAUSSIAN70, an ab initio molecular orbital computer code, to any number of atomic orbitals is presented. Changes needed to redimension the code are shown. (GHT)

18374 EVALUATION OF A FOUR-ELECTRON ATOMIC INTEGRAL. Perkins, J. F. (Army Missile Command, Redstone Arsenal, AL). J. Comput. Phys.; 17: No. 4, 434-436(Apr 1975).

For calculations of four-electron atomic states, a series-summation scheme is described to evaluate the auxiliary integral (X integral) which arises when using Hylleraas-type expansions or a combination of Hylleraas-type and configuration-interaction wave functions. (GHT)

18375 NON-ORTHOGONAL ATOMIC ORBITALS. Cusachs, L. C. (Loyola Univ., New Orleans). Chem. Phys. Lett.; 31: No. 1, 154-156(15 Feb 1975).

The procedure of Raffenetti and Ruedenberg for defining non-orthogonal atomic orbitals is generalized to provide minimum-kinetic-energy atomic orbitals for use in applications of pseudopotential theory in atoms and molecules. (auth)

18376 APPROXIMATE CONSERVATION OF P-HELICITY IN ROTATIONAL EXCITATION: A NEW DECOUPLING SCHEME. Tamir, M. (Soreq Nuclear Research Center, Yavne, Israel); Shapiro, M. Chem. Phys. Lett.; 31: No. 1, 166-171(15 Feb 1975).

A new decoupling scheme for atom-rigid-rotor scattering based on Jacob and Wick's helicity formalism is suggested and found to be satisfactory for a wide range of systems of chemical interest. The number of coupled equations which needs to be solved simultaneously is greatly reduced. Conditions for the validity of this approximation are explored. Very accurate results are obtained for the opacity functions of the individual transitions. (auth)

18377 COMMENT ON ANALYTICAL CALCULATION OF ATOMIC AND MOLECULAR ELECTROSTATIC POTENTIALS FROM THE POISSON EQUATION. Kloepper, D.; Volkmer, P. (Karl-Marx Univ., Leipzig, Ger.). Chem. Phys. Lett.; 31: No. 1, 186(15 Feb 1975).

The assumption, by S. Srebrenik, et. al. (Chem. Phys Letters 20(1973) 419) that methods used for the calculation of atomic and molecular electrostatic potentials phi(r) require numerical integrations of the form phi/sub ab/(r) equals integral rho/sub ab/(r') parallel r'- r parallel^{-1} dnu' is stated to be incorrect because, for a Gauss-type-orbital basis, a closed analytical form exists for the integral. (GHT)

18378 ISOTOPE SHIFTS, CHEMICAL SHIFTS, AND HYPERFINE INTERACTION OF ATOMIC K X RAYS. Boehm, F. (California Inst. of Tech., Pasadena). pp 411-441 of Atomic Inner-Shell Processes. I. Ionization and Transition Probabilities. New York; Academic Press, Inc. (1975).

The discussion of isotope and chemical shifts and hyperfine interaction of atomic K x rays includes experimental methods for isotope shift and chemical shift measurements, isotope shift, and tabulations of previous data. (JFP)

18379 NEW-TYPE CORRELATED WAVEFUNCTIONS FOR THREE-BODY SYSTEMS WITH COULOMB INTERACTION. Cavaliere, P.; Ferrante, G.; Geracitano, R.; Lo Cascio, L. (Istituto di Fisica dell'Università, Palermo, Italy Gruppo Nazionale di Struttura della Materia del CNR, Palermo, Italy). J. Chem. Phys. 63: No. 2, 624-627 (15 July 1975).

Simple correlated wavefunctions are reported for the ground states of three selected Coulombic systems, namely (1) the positronium negative ion $e^-e^+e^-$, (2) the hydrogen negative ion H^-, and (3) the mesic molecular ion $p\mu p$. They give quite accurate energy results, and are analytically simple enough to be used widely in applications. Two characteristic features of the proposed wavefunctions are that (1) the correlation between the two particles with the same sign of the charge is explicitly included in the form $G = x^n{}_3 e^{-\gamma x_3}$, and (2) the variational parameters to be optimized are mostly nonlinear (exponential). (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstract 17065.

18380 DUAL ALFVEN WAVES IN SUPERFLUIDS WITH HIGH ELECTRICAL CONDUCTIVITY. Amte, P. G. (Rajaram Coll., Kolhapur, India). Indian J. Phys.; 48: No. 9, 843-845(Sep 1974).

The propagation of an MHD wave in a superfluid with high electrical conductivities for the two components of the superfluid is considered. Although there is no such fluid to test the pressure of such waves, it is thought that some stellar objects may indicate the presence of such waves. (MHR)

18381 STEADY HYDROMAGNETIC FLOW BETWEEN TWO POROUS CONCENTRIC CIRCULAR CYLINDERS. Sengupta, P. R. (Univ. of Kalyani, Nadia, India); Ghosh, S. K. Czech. J. Phys.; 25: No. 5, 514-520(1975).

The MHD effects on the steady flow of an incompressibe viscous conducting fluid through two concentric porous non-conducting infinite circular cylinders, rotating in various ways with uniform angular velocities in presence of a radial magnetic field are studied. It is supposed that the rate of suction at the inner cylinder is equal to the rate of injection at the outer. (auth)

18382 MAGNETOHYDRODYNAMIC SOURCE FLOW BETWEEN TWO PARALLEL POROUS DISKS ONE OF WHICH IS ROTATING. Datta, N.; Mazumder, B. S. (Indian Inst. of Technology, Kharagpur). Indian J. Phys.; 48: No. 12, 1105-1116(Dec 1974).

The steady magnetohydrodynamic laminar source flow of an incompressible conducting fluid between two parallel porous disks one of which is rotating and other is stationary in the presence of a transverse magnetic field has been analytically investigated. The solution has been obtained by expanding the velocity components and pressure in a power series of reduced Reynolds number R_s/r^2, where R_s is the source Reynolds number and r is the radial distance. The effect of the magnetic field on the velocity profiles is to flatten them near the central region between the disks. The skin-friction, torque and pressure drop in the radial direction increase with the increase of Hartmann number M with the exception that the skin-friction decreases when $1 < M < 2$ and the torque decreases when $0 < M < 1$. (auth)

18383 PLAZMA NA ZEMLE I V KOSMOSE. (Plasma on the Earth and in Space). Oraevskii, V. N. Kiev; Izdatel'stvo Naukova Dumka (1974). 171p.

This book discusses natural phenomena associated with a plasma which is the most widely distributed state of matter in space, and the uses of a plasma created artificially under laboratory conditions. The problems of controlling thermonuclear reactions, and applied problems of magnetohydrodynamics and gasodynamics are discussed. A discussion is presented on the origin and structure of the Earth's magnetic field and on magnetic storms and polar lights. Present concepts on young, old and dying stars are presented on cosmic sources of radio- and infrared radiation such as radiogalaxies, quasars and pulsars. (SJR)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

18384 (COO-1545-162) HIGH ENERGY PHYSICS STUDIES. Progress Report Part I. Experimental Program. (Ohio State Univ., Columbus (USA). High-Energy Physics Lab.). 1975. Contract E(11-1)-1545. 59p. Dep. NTIS $6.00.

Research on experimental high energy physics is summarized. A list of publications is included. (JFP)

Electromagnetic

18385 (CEA-CONF-3036) STUDY OF THE $\gamma + D \rightarrow p + \pi^- + p_s$ REACTION FOR MEDIUM AND HIGH "SPECTATOR" MOMENTA. Argan, P. E.; Audit, G.; de Botton, N.; Faure, J. L.; Laget, J. M.; Martin, J.; Schuhl, C.; Tamas, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique Nucleaire). Nov 1974. 2p. (CONF-750222-6). Dep. NTIS (US Sales Only) $4.00.

From symposium on interaction studies in nuclei; Mainz, F. R. Germany (17 Feb 1975).

Values of the cross section are studied, and a search is made for departures from the spectator model are made. The latter is of great interest for the understanding of the anomaly found in the analysis of the high recoil momentum data for the $^4He(\gamma, p\pi^-)$ reaction. The range of the invariant mass of the detected πN pair goes from 1140 to 1310 MeV. In the low and medium spectator momenta, the data are consistent with the previously known measurement, but the high spectator momentum data show significant departures from the model. (JFP)

18386 (EGG-1183-2315) CERENKOV IMPULSE DISPERSION IN LOW-LOSS FIBERS. Nelson, M. A.; Franks, L. A.; Davies, T. J. (EG and G, Inc., Santa Barbara, Calif. (USA)). May 1975. 9p. (CONF-750901-1). Dep. NTIS $4.00.

From International conference on optical fibre communications; London, UK (19 Sep 1975).

The dispersion of a spectrally-broad Cherenkov impulse of light generated in one end of both 500 m graded and step index fibers was measured. The 16-ns wide output pulse was decreased to less than 2 ns from the graded index fiber by restricting the detected spectrum to 5 nm using narrow band optical filtering. Attempts at further reduction were limited by inadequate measurement system sensitivity. The step index fiber response was not reducible below 4 ns, probably a consequence of residual mode dispersion. (auth)

18387 PHOTOMESON PRODUCTION, NUCLEAR TRANSPARENCIES AND SIMPLE DIRECT REACTIONS. Di Napoli, V. (Univ., Rome). Lett. Nuovo Cim.; 12: No. 16, 609-615(19 Apr 1975).

The dependence of pion photoproduction cross sections is discussed with reference to results obtained by others. Data from photomeson production experiments are compared with cross sections measured from simple direct reactions. The question of whether nuclear transparencies could furnish information on the dependence of the cross sections on A is considered. The discussion is limited to photon induced reactions at energies between .3 and 1 GeV. (2 figures) (SDF)

18388 COALESCENCE OF TWO PHOTONS INTO ONE ON THE ELECTRON. Smirnov, A. I. (Kostroma State Pedagogical Inst., USSR). Yadern. Fiz.; 21: No. 3, 586-592(Mar 1975). (In Russian).

The differential and total rates of the coalescence of two photons into one on the electron are calculated by Feynman's method, when the momenta of the initial quanta are parallel. Various kinematical configurations of the process are considered in the nonrelativistic and extreme relativistic energy regions of the incident photons. The rate of the coalescence effect on an electron is compared with that proceeding in atomic nuclear field. (auth)

18389 TOTAL CROSS SECTIONS OF THE HADRONIC ABSORPTION OF HIGH ENERGY PHOTONS BY NUCLEONS. Belousov, A. S.; Budanov, N. P.; Vazdik, Ya. A. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 21: No. 3, 556-566(Mar 1975). (In Russian).

Total cross sections of hadronic photoabsorption are measured at the energies from 12 up to 38.8 GeV for protons and from 12 up to 30 GeV for deuterons. Data on the photoabsorption total cross sections are obtained for neutrons. Analysis of all the data on the photoabsorption total cross sections, available in the literature, shows that in the energy range 2 to 38 GeV the energy dependence of the total cross sections may be described by the formula $\sigma = a + bE_\gamma^{-\frac{1}{2}}$. The quantities a and b are determined by contributions from the P, P' and A_2 Regge trajectories to the cross section. Comparison of the experimental results with predictions of the vector-meson dominance model indicates a discrepancy, the magnitude of which is about 10% at all the energies. (auth)

18390 POLARIZED ELECTRON-ELECTRON SCATTERING AT GeV ENERGIES. Cooper, P.S.; Alguard, M.J.; Ehrlich, R.D.; Hughes, V.W.; Kobayakawa, H.; Ladish, J.S.; Lubell, M.S.; Sasao, N.; Schüler, K.P.; Souder, P.A. (J. W. Gibbs Laboratory, Yale University, New Haven, Connecticut 06520); Baum, G.; Raith, W.; Kondo, K.; Coward, D.H.; Miller, R.H.; Prescott, C.Y.; Sherden, D.J.; Sinclair, C.K. Phys. Rev. Lett. 34: No. 25, 1589-1592 (23 June 1975).

The longitudinal polarization of the new Yale University-Stanford Linear Accelerator Center polarized-electron beam has been determined at laboratory energies between 6.47 and 19.40 GeV. Spin-dependent elastic electron-electron scattering (Moeller scattering) has been found to be a practical technique for polarization measurements at high energies. The results are consistent with the energy and angular dependence predicted by quantum electrodynamics and with an energy-independent beam polarization of 0.76 ± 0.03. (auth)

Weak

18391 (COO-1545-160) OBSERVATION OF A DIFFERENCE BETWEEN POLARIZATION AND ANALYZING POWER IN LAMBDA^0 PRODUCTION WITH 6 GeV/c POLARIZED PROTONS. Lesnik, A.; Schwartz, D. M.; Ambats, I.; Hayes, E.; Meyer, W. T.; Ward, C. E. W.; Knasel, T. M.; Swallow, E. C.; Winston, R. Romanowski, T. A. (Argonne National Lab., Ill. (USA); Chicago Univ., Ill. (USA); Ohio State Univ., Columbus (USA)). Jun 1975. 10p. Dep. NTIS $4.00.

The polarization, analyzing power, and depolarization parameter were measured for forward lambdas produced with a 6-GeV/c polarized proton beam at the Argonne National Laboratory Zero Gradient Synchrotron. A sample of 15281 LAMBDA^0 production events with subsequent $p\,\pi^-$ decays was collected. There is a clear difference between the polarization and analyzing power for events with Feynman scaling variable x greater than 0.8. This is the first observation of this phenomenon at high energy. (auth)

18392 (SLAC-181) EXPERIMENTAL STUDY OF THE DECAY K^0/sub L/ YIELDS $\pi^+\pi^-\pi^0$. Slone, D. N. (Stanford Linear Accelerator Center, Calif. (USA)). Aug 1974. Contract AT(04-3)-515. 160p. Dep. NTIS $6.25.

An experiment designed to be almost free of systematic biases so that the corrections to data were at the 2 percent level is summarized briefly for the decay K_2^0 yields $\pi^+\pi^-\pi^0$. The decay spectrum was found to depend on the neutral pion center-of-mass kinetic energy in a manner well described by a given matrix element. A comparison with K^+ decays shows a significant violation of the delta I equals ½ rule for hadronic weak decays. (JFP)

18393 PHYSICS NEWS. Skjeggestad, O. (Bergen Univ.). Naturen.; 99: No. 2, 61-65(1975). (In Norwegian).

A rather general discussion of weak interactions, especially related to neutrino interactions, precedes a presentation of the significance of the discovery in 1973 at CERN of events which are interpreted as weak interactions with neutral current. Further experiments to confirm neutral current events are mentioned. (JIW)

Strong (Baryon-induced)

Refer also to abstracts 18575 and 18738.

18394 (CRN/HE-74-19) ANTIPROTON–DEUTERIUM INTERACTIONS AT 14.6 GeV/c. Fridman, A. (Centre National de la Recherche Scientifique, 67- Strasbourg (France). Centre de Recherches Nucleaires). 1974. 8p. Dep. NTIS (US Sales Only) $4.00.

Some results on the $\bar{p}d \rightarrow p\bar{p}p\pi^-$ and $\bar{p}d \rightarrow \bar{p}d\pi^+\pi^-$ reactions at 14.6 GeV/c in a deuterium-filled bubble chamber are presented. Although the statistics are small, one can discuss some aspects of the production processes. Cross sections for both reactions are discussed. For the first reaction a low mass $p\pi^-$ enhancement

at about 1.4 GeV/c and the presence of some weak $\bar{\Delta}^{--}p$ production are seen. The dominant features of the second reaction are $d^* \rightarrow d\pi^+$ and $\bar{\Delta}^{--} \rightarrow \bar{p}\pi^-$ production. (JFP)

18395 (LBL-3827) STUDY OF SIGMA(1670) RESONANCE PRODUCTION K^-p INTERACTIONS. Estes, R. D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 122p. Dep. NTIS $9.25.

Thesis.

Production of the SIGMA(1670) resonance in the reactions K^-p yields LAMBDA $pi^+ pi^-$, K^-p yields $SIGMA^0 pi^0 pi^-$, K^-p yields $SIGMA^- pi^+ pi^0$, and K^-p yields $SIGMA^{--} pi^- pi^+ pi^-$ for K beam momenta around 2.1 and 2.6 GeV/c in data from the Bevatron 72-inch hydrogen bubble chamber is analyzed. Large variations in the ratio of the cross section for the reaction K^-p yields $SIGMA^+(1670)pi^-$ yields $LAMBDA(1405)pi^+pi^-$ yields $SIGMA^{--} pi^- pi^+ pi^-$ to the cross section for the reaction K^-p yields $SIGMA^+(1670)pi^-$ yields $(SIGMApi)^+pi^-$ as a function of the SIGMA(1670) production angle. This variation is interpreted as strong evidence that more than one resonance contributes to the SIGMA(1670) enhancement. Analysis of the production angular distributions of the three SIGMA(1670) decay modes LAMBDApi, SIGMApi, and LAMBDA (1405)pi shows that the results are consistent with the existence of a SIGMA(1670) resonance that decays mainly into LAMBDA (1405)pi and another that decays mainly into LAMBDApi and SIGMApi. Other production experiments are seen to be consistent with these results. The LAMBDApi/SIGMApi branching ratio is estimated to be 0.8 +- 0.1. The data are also consistent with the existence of two interfering SIGMA(1670) resonances with approximately equal masses and widths. (auth)

18396 (NP-20503) STRANGE AND NONSTRANGE PARTICLE PRODUCTION IN PROTON-PROTON REACTIONS AT AN INCIDENT MOMENTUM OF 19 GeV/c. Svedin, U. (Stockholm Univ. (Sweden). Fysiska Institutionen). 1974. 101p. Dep. NTIS (US Sales Only) $8.25.

Thesis.

Proton-proton interactions are studied at 19 GeV/c, and the production of strange particles is compared with the production of nonstrange particles. The following inclusive and semi-inclusive cross sections are found: $\sigma(\Lambda) = 1.86 \pm 0.06$ mb, $\sigma(K_s^0) = 1.27 \pm 0.04$ mb, $\sigma(\Lambda K) = 1.78 \pm 0.06$ mb, $\sigma(YK) = 2.73 \pm 0.23$ mb, $\sigma(K\bar{K}) = 1.46 \pm 0.14$ mb, σ(strange particles) = 4.3 ± 0.3 mb. Multiplicity distributions are found, and the scaling properties of the momentum spectra are studied. Factorization holds, at least to a 25% level for the inclusive interactions. (auth)

18397 (USIP-74-25) MEASUREMENTS OF STRANGE PARTICLE PRODUCTION CROSS SECTIONS IN PROTON–PROTON REACTIONS AT 19 GeV/c INCIDENT MOMENTUM. Alpgard, K.; Hulth, P. O.; Svedin, U.; Yamdagni, N. (Stockholm Univ. (Sweden). Fysiska Institutionen). Nov 1974. 54p. Dep. NTIS (US Sales Only) $5.75.

Exposures, geometrical reconstruction, scanning procedure, data processing and selection, and weighting procedure are given in the determination of cross sections from an experiment at 19 GeV/c studying strange particle final states in pp interactions. Strange particle pair cross sections are obtained from one or two seen strange particle decays, and cross sections are calculated based on V^0 observations. The cross sections for $\Sigma^{\pm}$ are determined in particular. (PJS)

18398 PION P_T DISTRIBUTION AND A TEST OF SCALING HYPOTHESIS AT AN INCIDENT PROTON ENERGY OF 24 GeV. Daftari, I. K.; Bandyopadhyay, B. K.; Roy, T. (Jadavpur Univ., Calcutta). Ann. Phys. (Leipzig); 31: No. 4, 338-342(Nov 1974).

The transverse momentum distribution of 900 secondary pions produced in interactions of 24-GeV protons with emulsion nuclei is seen to agree fairly well with the Hagedorn distribution for "a" = ½ and "b" adjusted to 133 MeV. A satisfactory fit of Feynmans scaling idea is also observed at this incident energy. (auth)

18399 NUMBER OF CHARACTERISTICS OF PROTON–NUCLEAR INTERACTIONS AT ENERGIES OF 20 TO 70 GeV. Azimov, S. A.; Gulamov, K. G.; Navothyi, V. Sh.; Skripnik, N. S.; Chernov, G. M. (Physical-Technical Inst., Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 11, 23-26(1974). (In Russian).

This study considers the multiplicities of secondary particles in "p-nucleus" interactions at momenta p_o = 25, 50 and 67 GeV/c, where 635, 337 and 523 inelastic events respectively were found by scanning of photoemulsion tracks. The average multiplicities $\langle n_s \rangle$, $\langle n_g \rangle$, $\langle n_b \rangle$, $\langle N_h \rangle$ and ratio $\langle n_b \rangle / \langle n_g \rangle$ were found to be respectively: 6.6 ± 0.2, 2.9 ± 0.1, 4.4 ± 0.2, 7.3 ± 0.3 and 1.54 ± 0.10 at p_o = 25 Gev/c; 8.4 ± 0.4, 2.5 ± 0.1, 4.3 ± 0.3, 6.8 ± 0.4 and 1.66 ± 0.16 at p_o = 50 Gev/c; 8.9 ± 0.3, 2.6 ± 0.1, 4.6 ± 0.2, 7.2 ± 0.3 and 1.73 ± 0.12 at p_o = 67 Gev/c. A model of a two-stage type based on a mechanism of generating particles through intermediate states (clusters) describes the experimental data approximately. (3 figures, 1 table) (SJR)

18400 TOTAL CROSS SECTIONS AND ELASTIC SCATTERING AT VERY HIGH ENERGIES. Giacomelli, G. (National Accelerator Lab., Batavia, IL). pp 247-277 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

Experimental results from the CERN-ISR on high energy and elastic proton-proton scattering is presented, particularly total cross sections and angular distributions. Emphasis is placed on the rising k_p^+ and pp total cross sections, the change of sign of the ratio of the real and imaginary part of the forward pp scattering amplitude and the diffraction-like structure of the pp angular distribution. It appears that both the elastic and the inelastic total pp cross sections are rising with energy. (MGH)

18401 ORIGINS AND CONSEQUENCES OF INDEFINITELY RISING TOTAL CROSS SECTIONS. Zachariasen, F. (California Inst. of Tech., Pasadena). pp 601-629 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

Experiments indicate a growth with energy of the proton–proton total cross section. Some models are discussed that yield this result. Also discussed are some results, model independent, that follow from the growth of the asymptotic cross section. (MGH)

Strong (Meson-induced)

Refer also to abstract 18533.

18402 (USIP-75-02) ANNUAL REPORT 1974 ON PARTICLE PHYSICS. (Stockholm Univ. (Sweden). Fysiska Institutionen). Jan 1975. 71p. Dep. NTIS (US Sales Only) $6.75.

The research program comprises a detailed study of amplitudes in 4-GeV π^-p reactions leading to strange particle production, annihilation and nonannihilation processes in 9 and 12 GeV antiproton-proton collisions, production of strange particles and final state properties in 19-GeV pp collisions, multiparticle final states including clustering effects also in 19-GeV pp and a measurement of isospin amplitudes governing single pion production in nucleon–nucleon reactions. A search for a possible $\Delta\Delta$-component in the deuteron wave function is made, using data from the 19-GeV pd-experiment. One counter experiment has the aim to study hypercharge exchange processes, another the elastic scattering differential cross sections of pions, kaons, protons and antiprotons on protons at energies of 10, 9, and 6.2 GeV. Investigations of antiproton-proton annihilations at 6.2 GeV are also in progress. A list of publications is included. (auth)

18403 ANALYSIS OF THE CHANNELS $K\text{-}p \rightarrow \bar{K}\,N\pi$ BY 4.2 GeV/c. Tiecke, H. G. J. M. Nijmegen, Netherlands; Katholieke Univ. (1974). 178p. (In Dutch).

Thesis.

As part of the 4.2 GeV/c K^- meson experiment in the CERN 2 meter hydrogen bubble chamber, about 300,000 pictures are scanned on the channels $K^-p \rightarrow K^-p\pi^0$, $K^-p \rightarrow \bar{K}^0p\pi^-$ and $K^-p \rightarrow K^-n\pi^+$. Total cross sections of these reactions are 690 ± 40 μb, 770 ± 30 μb and 1070 ± 40 μb, while for the total cross section of the whole K^-p reaction, 24800 ± 600 μb is found. With the help of Dalitz plot fits and prisma plot analysis (PPA) the cross sections for the production of the K^*_{892}, K^*_{1420} and Δ_{1236} particle resonances and for the diffractively produced $(N\pi)$ systems are derived: $\sigma(K^-p \rightarrow K^{*0}_{892}p) = (683 \pm 60)\mu b$, $\sigma(K^-p \rightarrow K^-\Delta^+_{1236}) = (102 \pm 40)\mu b$, $\sigma(K^-p \rightarrow \bar{K}^{*0}_{892}n) = (345 \pm 70)\mu b$, $\sigma(K^-p \rightarrow \bar{K}^0\Delta^0_{1236}) = (26 \pm 10)\mu b$, $\sigma(K^-p \rightarrow K^{*-}_{1420}p) = (341 \pm 40)\mu b$, $\sigma(K^-p \rightarrow K^-(N\pi)^+) = (379 \pm 110)\mu b$, $\sigma(K^-p \rightarrow K^{*0}_{1420}n) = (253 \pm 60)\mu b$. The central mass values as well as the particle widths of the K* resonances are found from a Breit–Wigner fit to the PPA results. Except for the central mass value of the K^*_{1420} resonance, all values are found to be a few standard deviations above the world average. In contrast to K^*_{892}, it appears that the differential cross section with respect to the Mandelstam variable t' (in GeV^2) for K^{*0}_{892} and both K^*_{1420} can be better parametrized by a sum of two exponential functions instead of one. The decay of the K* resonances is studied in the Gottfried–Jackson system, and spin density matrix elements are derived. The asymmetric decay distribution for the $\bar{K}^{*0}_{892}$ resonance can be explained as an interference effect with background events or with the diffractively produced $(N\pi)$ systems. The K^*_{892} resonances can well be explained both in terms of the Regge-pole model. (NL)

Particle Interactions and Properties (Theoretical)

General

Refer also to abstracts 18773, 18783, and 18790.

18404 NEUTRINOS AND NUCLEON STRUCTURE. Perkins, D. H. (Oxford Univ.). Contemp. Phys.; 16: No. 2, 173-205 (Mar 1975).

"Deep inelastic" collisions of neutrinos and antineutrinos with nucleons behave as if the nucleon was composed of pointlike constituents (partons and antipartons). Neutrino experiments can measure the net number of partons-antipartons, their angular momentum and mean square charge; they are 3 in number, have spin $\frac{1}{2}$ and possess the fractional charges postulated ten years ago for the fundamental quarks, by Gell-Mann and Zweig. However, the observation of neutral as well as charged currents in neutrino reactions has compelled introduction of further quantum numbers; for example, a fourth quark with "charm". Recent electron-positron collision experiments also suggest new degrees of freedom—"charm" and/or "colour". The effects of these and other modifications to the quark model on neutrino cross-sections are discussed. (auth)

18405 MULTIPERIPHERAL AND PARTON MODELS FOR HIGH ENERGY PROCESSES. Abarbanel, H. D. I. (National Accelerator Lab., Batavia, IL). pp 3-75 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

A description of the multiperipheral and parton models is given for high energy collisions. Both models are given useful interpretations in spite of their simplicity. A study is made of the physics of both models. For the multiperipheral model, scattering amplitudes for elastic collisions and particle production are developed followed by some of the information available from the integral equations. For the parton model, inelastic lepton scattering is studied followed by a quark interpretation of partons. (MGH)

18406 INELASTIC REACTIONS AT VERY HIGH ENERGIES. Giacomelli, G. (National Accelerator Lab., Batavia, IL). pp 145-246 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

A review of particle production from high energy, inelastic collisions through the use of inclusive reaction. Experimentally a look is made at the cutoff in the transverse momentum and its dependence on experimental parameters, scaling, factorization, leading particle effects and correlations. Theoretical models are discussed to explain the results. No one model can completely explain all the data. Finally a list of problems that need to be answered is given. (MGH)

18407 TWO-COMPONENT MODELS FOR PARTICLE PRODUCTION. Quigg, C. (State Univ. of New York, Stony Brook). pp 519-600 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

The basic idea of two-component models is the multiperipheral and diffractive theories of particle production. These two theories are not the final answer for models but they do explain most of the experimental features. Unitarity is needed to connect them. The theories may lead to more complete pictures of hadronic interactions. (MGH)

18408 SOFT-MASS RENORMALIZATION OF THE SIGMA-MODEL. Maison, D. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Nuovo Cim., A; 26A: No. 4, 360-374 (21 Apr 1975).

Soft-mass renormalization, a variant of the BPHZ renormalization scheme, is applied to the σ-model. Artificial infrared divergences, introduced by the subtraction scheme, show up and are removed by finite renormalizations. Canonical Ward-Takahashi identities are obtained. The σ-model is considered as a test case for the treatment of non-Abelian gauge theories where similar problems are present. (auth)

18409 ASYMPTOTIC BEHAVIOR AT EXCEPTIONAL MOMENTA. Thun, H. J. (Deutsches Elektronensynchrotron, Hamburg). Nuovo Cim., A; 26A: No. 4, 329-359(21 Apr 1975).

A method is developed for investigating the asymptotic behavior of vertex functions at certain Minkowskian exceptional momenta. It is a direct generalization of earlier treatments of Euclidean exceptional momenta. It makes use of formal expansions in momentum space, closely related to light-cone expansions in position space. The expansions have to be performed in those channels which carry finite total momentum squared and admit (in A^4-theory) two-particle intermediate states. (auth)

18410 COMMUTATION AND ANTI-COMMUTATION RELATIONS FOR A CLASS OF GEL'FAND-YAGLOM MATRICES. Bracken, A. J. (Queensland Univ., St. Lucia, Australia). J. Phys., A (London); 8: No. 5, 800-807(May 1975).

A realization is given, in terms of Dirac matrices and suitable SL(2,c) generators, of Gel'fand-Yaglom matrices associated with the simplest parity-invariant wave equations for particles with half-odd-integral spin. Commutation and anti-commutation relations for these matrices are thereby derived, replacing those given previously by Lorente, Huddleston and Roman (J. Math. Phys.; 14: 1495 (1973)), which are shown to be incorrect. (auth)

18411 ELEMENTARY PARTICLE BASE MASSES. Dixon, G. (Brandeis Univ., Waltham, MA). Int. J. Theor. Phys.; 12: No. 3, 153-156(Feb 1975).

Empirically based contention that there exists an integral mass system for the principal baryons and the electron is put into a theoretical framework. This framework predicts a neutrally charged lepton which must correspond to the neutrino, generates very accurate base masses for the major leptons, mesons, and baryons and extremely accurate mass splitting for the principal octet of baryons. In addition, it predicts a totally new class of super heavy particles the lightest of which would have a mass greater than 38 GeV. (auth)

18412 POSSIBILITY TO EXPLAIN THE TWO-COMPONENT STRUCTURE OF THE MULTIPLICITY DISTRIBUTIONS IN TERMS OF THE MULTI-REGGEON MODEL. Arestov, Yu. I.; Moiseev, A. M. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 21: No. 3, 641-644(Mar 1975). (In Russian).

One- and two-shower processes are considered (without cuts) that determine the multiplicity distribution of the charged particles as a sum of two Poisson terms. A proof is presented that the two-shower processes produce twice as much negative particles than the one-shower processes. For large energies $\langle n_{\pm} \rangle = 3a + 2$, where a is the mean number of π^- mesons in one shower and $a \sim \ln s$. The presence of a third term in the π^--multiplicity distribution at large energies is indicated. This term is of the form $(3a - \delta/2)^m/m!$, where δ is the mean number of protons in an interaction event. (auth)

18413 DEPARTURE FROM EXPONENTIAL DECAY LAW. Shirokov, M. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 3, 674-687(Mar 1975). (In Russian).

The time dependence of the decay law is discussed in the frame of a solvable theoretical model. New quantum-mechanical definition of the decay law N(t) is proposed. It is shown that there exists such a description of an unstable state that N(t) decreases not slower than an exponent when $t \to \infty$. In the model frame one can propose other descriptions which turn the new definition into the usual one. Then N(t) acquires nonexponential asymptotics. The decay interaction is found to be nonlocal in such cases. The nonlocality can be made so small that the departure of N(t) asymptotics from exponential one will be unobservable. (auth)

Electromagnetic

Refer also to abstract 18319.

18414 (CEA-CONF-3037) $\gamma + D \to p + p + \pi^-$ REACTION FOR HIGH MOMENTUM VALUES OF THE "SPECTATOR" NUCLEON. Argan, P. E.; Audit, G.; Blomqvist, I.; de Botton, N.; Faure, J. L.; Laget, J. M.; Martin, J.; Schuhl, C.; Tamas, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1975. 5p. (CONF-750222-5). Dep. NTIS (US Sales Only) $4.00.

From symposium on interaction studies in nuclei; Mainz, F. R. Germany (17 Feb 1975).

The $D(\gamma,p\pi^-)$ p reaction yield for high momentum values of the undetected nucleon are measured. Also the measurement was extended to low momentum values of the undetected nucleon, and the $\gamma + n \to p + \pi^-$ reaction cross section was deduced with better statistical accuracy, better energy, and better angular resolution than in the previously published data. (JFP)

18415 (ITP-74-124E) NEW SUM RULES FOR HADRON ELECTROMAGNETIC FORM FACTORS AND RADII. Kelemen, V. I.; Lomsadze, Yu. M. (AN Ukrainskoj SSR, Kiev. Inst. Teore-

ticheskoj Fiziki). 1974. 34p. (CONF-7310111-1). Dep. NTIS (US Sales Only) $4.75.

From 9th all-union conference on elementary particle theory; Ushgorod, USSR (Oct 1973).

Proceeding from general properties of the averaged electromagnetic form factor which are rigorously proved within the framework of the axiomatic quantum field theory one obtains a number of new integral and local sum rules for the modulus of this form factor in the physical region of the scattering and annihilation channels or only of the annihilation channel. New bounds of the pion mean-square radius are also obtained in terms of its electromagnetic form factor in the same physical region. A part of these sum rules and bounds are sensitive to high energy behavior of the form factor, this sensitivity being capable of regulating in any preassigned way. The other part, on the contrary, is practically insensitive to its behavior outside the working energy region which can be chosen at will. (auth)

18416 LEPTON HADRON INTERACTIONS: DEEP INELASTIC ELECTRON SCATTERING. Barish, B. C. (California Inst. of Tech., Pasadena). pp 80-101 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

Deep inelastic electron scattering data is interpreted in terms of simple quark-parton models. The point like behavior of the cross section is noted and scaling laws are approached very quickly. The form factors approach the quark model predictions. (MGH)

18417 0(4.2): AN EXACT INVARIANCE ALGEBRA FOR THE ELECTRON. Bracken, A. J. (Queensland Univ., St. Lucia, Australia). J. Phys., A (London); 8: No. 5, 808-815(May 1975).

It is shown that the Lie algebra 0(4,2) is an exact invariance algebra of Dirac's equation. The elements of this algebra become equivalent to the generators of conformal transformations in the zero-mass or high energy limit, provided the helicity of the electron is held at an appropriate value. A picture is suggested of the electron as "a massless spin ½ particle in a space-time knot". (auth)

18418 GENERALISED MAGNETIC MONOPOLE FOR THE YANG-MILLS FIELD. Kerner, R. (Paris Univ., France). Int. J. Theor. Phys.; 12: No. 3, 177-182(Feb 1975).

By analogy to the magnetic monopole first proposed by Dirac (Proc. R. Soc.; A133: 60 (1931)), a generalized magnetic monopole, being a source of the Yang-Mills field, is constructed. The gauge invariance and the rotational symmetry lead in a natural way to the quantization not only of the electric charge but also of the hypercharge number Y. It is shown that the generalized magnetic charges are not arbitrary, and some restrictions on their values are deduced. (auth)

18419 COHERENT STATES AND RADIATION OF A CHARGED PARTICLE IN CROSSED FIELDS. Ivanova, E. V.; Malkin, I. A.; Man'ko, V. I. (Moscow Physical-Technical Inst.). Yadern. Fiz.; 21: No. 3, 664-673(Mar 1975). (In Russian).

The motion of an electron in crossed homogeneous magnetic and inhomogeneous electric fields is considered. The dynamical symmetry group $Sp(4,R) \times H(2)$, stationary and coherent states of the system are found, its spectrum and Green's function are obtained. Spontaneous and induced radiation of the system in stationary and nonstationary states are calculated in the dipole approximation. The classical limit is considered. Based on the dynamical symmetry of the system, the spontaneous radiation accompanying the transition between stationary states is strictly calculated. (auth)

18420 PRODUCTION OF π^+ MESONS INDUCED BY POLARIZED PHOTONS IN THE ENERGY RANGE 220 TO 280 MeV. Zabaev, V. N.; Kuznetsov, V. M.; Polylitsyn, A. P.; Repenko, E. V.; Stukov, O. I.; Shumilov, B. M. (Tomsk Polytechnic Inst., USSR). Yadern. Fiz.; 21: No. 3, 551-555(Mar 1975). (In Russian).

In order to get additional information necessary for the multipole analysis, the asymmetry is measured in production of π^+ mesons on protons induced by linear-polarized photons. The experimental data are obtained for the photon energies 220, 230, 240, 260 and 280 MeV mainly at large angles in the region where the data were absent until now. The phenomenological analysis indicates to the simplest mechanism of the π^+-meson production in the S and P states. Five independent parameters are obtained as functions of the multipole amplitudes. (auth)

18421 PHOTOPRODUCTION OF ELECTRON-POSITRON PAIRS ON A NUCLEUS IN A STATIONARY EXTERNAL FIELD. Borisov, A. V.; Zhukovskii, V. Ch. (Moscow State Univ.). Yadern. Fiz.; 21: No. 3, 579-585(Mar 1975). (In Russian).

The cross section of photoproduction of electron-positron pairs on a nucleus in a stationary external magnetic field is calculated by the equivalent photon method. The cross section dependence on the external field strength H and the γ-quantum energy ω and on the polarization states of the particles involved is considered. It is shown that the optimal effect of the magnetic field on the process is observed in the region where the characteristic parameter $\kappa = \omega H/mB_0 \sim 1$ ($B_0 = m^2/e_0 = 4.41 \cdot 10^{13}$ G). (auth)

18422 WAYS TO MEASURE LINEAR POLARIZATION OF γ QUANTA. Kel'ner, S. R.; Kotov, Yu. D.; Logunov, V. M. (Moscow Engineering-Physical Inst.). Yadern. Fiz.; 21: No. 3, 604-609 (Mar 1975). (In Russian).

Parameters of azimuthal asymmetry of the secondary particle emission plane are calculated for the photoeffect, the Compton effect and for the pair production in the total energy range. For the pair production process the asymmetry parameter is calculated with account of the multiple scattering. The optimal width of the convertor is calculated. The results may be used to determine the γ-quanta linear polarization degree. (auth)

18423 INCLUSIVE e^+e^- ANNIHILATION INTO HADRONS ACCOMPANIED BY EMISSION OF TWO HARD PHOTONS. Esaibegyan, S. V.; Matinyan, S. G. (Erevan Physical Inst.). Yadern. Fiz.; 21: No. 3, 610-616(Mar 1975). (In Russian).

It is shown that at high energies the inclusive process of the e^+e^- annihilation into hadrons, accompanied by emission of two hard photons, at limited momenta of the observed hadron, may contribute a considerable fraction of the corresponding process with no photon emission. (auth)

18424 USE OF RADIATION EFFECTS TO DETERMINE WIDTHS OF RESONANCES. Baier, V.N.; Fadin, V.S. (Nuclear Physics Institute, Siberian Division, USSR Academy of Sciences). JETP Lett. 21: No. 5, 144-145 (5 Mar 1975).

We discuss the use of resonance radiation "tails" that appear in processes in which electron-positron pairs take part and are due to the shift to the resonance as a result of emission of a photon by the electron or positron for the purpose of determining the widths of the resonances observed at the end of 1974 in the Stanford and Brookhaven experiments. (auth)

18425 FORWARD DISPERSION RELATIONS AND LOW-ENERGY THEOREMS FOR COMPTON SCATTERING ON SPIN-1 TARGETS. Lin, K. Y.; Chen, J. C. (National Tsing Hua Univ., Hsinchu, Taiwan). J. Phys., G (London); 1: No. 4, 394-399(5 May 1975).

The differential cross section in the laboratory system for Compton scattering on polarized and unpolarized spin-1 targets is derived up to the second and third order in photon energy respectively. The results are expressed in terms of charge, magnetic dipole moment, electric quadrupole moment, and four structure-dependent constants. The forward dispersion relations and low energy theorems are combined to obtain two sum rules for these structure-dependent constants. The effects of C, P and T noninvariances are discussed. (auth)

18426 REPRESENTATION OF THE SPIN IN THE DIRAC EQUATION FOR THE ELECTRON. Koga, T. Int. J. Theor. Phys.; 12: No. 3, 205-215(Feb 1975).

The conventional interpretation of the spin matrices contained in the Dirac equation for the electron is considered to be mostly unintelligible in the operational sense. It is shown that it appears that the interpretation is often illogical. The necessity of a more comprehensible interpretation of the concerned equation is implied. (auth)

18427 TWO-BODY CORRELATIONS AND HIGH-ENERGY NUCLEAR PHOTOPROCESSES. Sanchez-Gomez, J. L. (Universidad Autonoma de Madrid (Spain)). Progr. Theor. Phys. (Kyoto); 51: No. 6, 1793-1800(Jun 1974).

The effect of nucleon-nucleon correlations on the cross sections of incoherent nuclear photoprocesses is discussed. Calculations are carried out in the case of high energy nuclear pion photoproduction where the decisive influence of the dynamical correlations is shown. (auth)

18428 EXPERIMENTAL CHECK OF QUARK MODEL PREDICTIONS FOR RHO ELECTROPRODUCTION. Hayashi, M.; Katsuura, K. (Saitama Medical Coll., Japan). Lett. Nuovo Cim.; 13: No. 9, 334-336(28 Jun 1975).

A comparison of quark model relations with experimental data for the rho electroproduction $ep \to e\ \rho^0\ p$ in the diffractive region obtained previously is reported. It is concluded that the quark model relations are in satisfactory agreement with the data of the rho electroproduction in the diffractive region. (JFP)

Weak

Refer also to abstract 18393.

18429 (BNL-20067) NEUTRAL CURRENTS IN SEMI-LEPTONIC REACTIONS. Paschos, E. A. (Brookhaven National Lab., Upton, N. Y. (USA)). May 1975. 21p. (CONF-750309-3). Dep. NTIS $4.25.

From 10th moriond meeting; Meribel-les-Allues, France (2 Mar 1975).

The evidence for weak neutral currents is analyzed in semi-leptonic reactions with special emphasis on their Lorentz and internal symmetry structure. It is found that present observations are consistent with the expectations of gauge theories, but other possibilities can not be ruled out. Of particular interest in this respect is the presence of a large isoscalar component. The excitation of the DELTA-resonance by neutral currents is analyzed, and pion-nucleon mass distributions are presented. Charge asymmetries sensitive to isoscalar-isovector interferences are discussed. (auth)

18430 LEPTON HADRON INTERACTIONS: DEEP INELASTIC NEUTRINO SCATTERING. Barish, B. C. (California Inst. of Tech., Pasadena). pp 103-127 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

Neutrino-hadron deep inelastic scattering total cross sections are used to find the relation between cross section and energy. The cross section rises linearly with neutrino energy in agreement with predictions from electron scattering. The coupling is consistent with pure vector-axial coupling theory, the results agree with a simple quark model and, scaling invariance appears to hold. (MGH)

18431 LEPTON HADRON INTERACTIONS: NEUTRINOS AND THE WEAK INTERACTION. Barish, B. C. (California Inst. of Tech., Pasadena). pp 129-144 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics Summer School; Montreal, Quebec (27 Aug 1973).

Weak interaction cross sections violate s-wave unitarity at high energies. This is rectified by a cutoff at present. Modifications to current-current theory of weak interactions are suggested to overcome this problem. W-bosons, heavy leptons, and neutral currents are proposed, and the status of the search for them is reviewed. (MGH)

18432 GAUGE THEORIES OF WEAK INTERACTIONS. I. Mostly Leptons. Primack, J. R. (Univ. of California, Santa Cruz). pp 460-482 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

An elementary introduction is given to semi-realistic models of leptons. It looks at neutral neutrino-antineutrino currents, heavy leptons, the Weinberg model, the Georgi-Glashow model, the properties, production and decay of heavy leptons and weak bosons and the expectation of neutral currents. (MGH)

18433 GAUGE THEORY OF WEAK INTERACTIONS. II. Hadrons. Primack, J. R. (Univ. of California, Santa Cruz). pp 483-498 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

A discussion of weak interactions of hadrons using gauge invariance is given looking at the models of Weinberg, Georgi and Glashow, and the charms. A number of unresolved problems are discussed. (MGH)

18434 GAUGE THEORY OF WEAK INTERACTIONS. III. More on Leptons. Primack, J. R. (Univ. of California, Santa Cruz). pp 499-515 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

A discussion of gauge theories of weak interactions is given with muons being the prime focus. A look is taken of anomalous muon interactions, attempts to understand why the rest mass of the electron is α times the rest mass of the muon and then some lepton–hadron analogies are given. Over all is the theme, from Feynman, "Why is the muon?" (MGH)

18435 POSSIBLE EXISTENCE OF A SMALL ADMIXTURE OF THE (V + A)(V + A) COUPLING IN THE EFFECTIVE LAGRANGIAN FOR THE μ DECAY. Mikheev, N. V.; Lipmanov, E. M. (Yaroslavl State Univ., USSR). Yadern. Fiz.; 21: No. 3, 617-627(Mar 1975). (In Russian).

Observable consequences are discussed of the simplest modification of the effective Lagrangian for the μ decay with a detailed account of the radiative corrections due to the electromagnetic interaction, found to be important in analysis of real experiments. The possibilities are taken into account that there exist one neutrino or two different 4-component neutrinos. Energy and angular distributions for various physical quantities are considered in some detail for the most essential domains near the ends of the electron spectrum. A systematic experimental study of these quantities is of substantial interest and will be more available at the "meson factories". (auth)

18436 MODIFICATION OF ADLER'S NEUTRINO SUM RULE DUE TO SECOND CLASS CURRENT. Khare, A.; Kawarabayashi, K. (Tokyo Univ. (Japan), Coll. of General Education). Progr. Theor. Phys. (Kyoto); 52: No. 1, 267-274(Jul 1974).

It is shown that Adler's sum rule for inelastic neutrino scattering gets modified in a specific manner if second class axial vector current is present. The consequences of the altered sum rule which no longer predicts scaling are discussed, and it is pointed out that this sum rule may offer the best testing ground for such currents. (auth)

Strong (General)

Refer also to abstract 18471.

18437 TWO-BODY HADRON REACTIONS. Kane, G. L. (Univ. of Michigan, Ann Arbor). pp 279-366 of Proceedings of the Canadian Institue of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

A phenomenological study is made to attempt to find the basic structure in high energy hadron physics. Unitarity effects are included at all energies. It is argued that all the ideas needed to explain hadron behavior are at hand. (MGH)

18438 DEEP INELASTIC SCATTERING AND THE STRUCTURE OF HADRONS. Gilman, F. J. (Stanford Linear Accelerator, Center, CA). pp IV.149-IV.173 of Proceedings of the 17th International Conference on High Energy Physics. Smith, J. R. (ed.). Chilton, Eng.; Science Research Council (1974).

From 17th international conference on high energy physics; London (Jul 1974).

18439 SPACE–TIME DEVELOPMENT OF MULTIPLE HADRON PRODUCTION. Kalinkin, B. N.; Shmonin, V. L. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 3, 628-640(Mar 1975). (In Russian).

The possibility to use the nuclear matter to verify the hypothesis on the space-time development of the multiple production of hadrons is discussed: an elementary act proceeds via formation of a bunch cluster of highly excited hadronic matter and the "leading" particle being in a "cut-off" state cannot interact with nucleons with previous intensity during relaxation of its own field. The movement of clusters in the matter is studied, and the parameters of their interaction with nucleons are obtained. It is shown that the hypothesis on realization of cluster states in multiple production does not contradict the data. (auth)

18440 GENERALIZED WEINBERG SUM RULE AND ESTIMATE OF THE DECAY WIDTHS OF NEW NEUTRAL VECTOR MESONS INTO LEPTON-ANTILEPTON PAIRS. Gerasimov, S.B.; Govorkov, A.B. (Joint Institute for Nuclear Research). JETP Lett. 21: No. 5, 140-141 (5 Mar 1975).

The use of the generalized Weinberg sum rule makes it possible to obtain an estimate for the widths of the decays of new neutral vector mesons, predicted by the three-triplet symmetrical quark model of the hadrons, into lepton-antilepton pairs. The value obtained for the width of the decay of the new ω_m meson is $9^{+3}_{-1.5}$ keV and is in satisfactory agreement with the experimental data for the recently discovered Ψ (3105) mesons. Predictions are made for other ρ_m and ϕ_m neutral vector mesons. (auth)

18441 ALGEBRAIC CONSTRAINTS FOR HIGGS MULTIPLETS. Ndili, F. N.; Okeke, P. N. (Univ. of Nigeria, Nsukka). Int. J. Theor. Phys.; 12: No. 3, 199-203(Feb 1975).

The phenomenon of spontaneous breaking of a gauge symmetry group provides a number of algebraic constraints which scalar Higgs mesons have to satisfy. These constraints are discussed, and details are given for the cases of SU(2), SU(2) × U(1) and SU(3). (auth)

18442 ARE HADRONS STRINGS. Strumia, A.; Venturi, G. (Univ., Bologna). Lett. Nuovo Cim.; 13: No. 9, 337-340(28 Jun 1975).

Another generalization to N-space dimensions of the usual string action leading to linearly rising trajectories and a spectrum distribution which depends on the dimensionality. Only for the case of a one-dimensional hadron does one recover a Hagedorn-like level density. It is concluded that although the Hagedorn distribution does not, by itself, determine the dimensionality of hadronic matter, it appears that once it is associated with a Lagrangian leading to linearly rising trajectories a one-dimensional extended structure (stringlike) for hadrons is favored. (JFP)

Strong (Baryon No. = 0)

18443 (ANL/HEP-CP-75-29) MASS OF THE p^0 IN NN ANNIHILATION. Fields, T.; Singer, R. (Argonne National Lab., Ill. (USA)). 2 May 1975. Contract W-31-109-Eng-38. 5p. (CONF-750547-7). Dep. NTIS $4.00.

From 4th international symposium on NN interactions; Syracuse, New York, USA (1 May 1975).

The rho peaks which are a prominent feature of the (pi^+pi^-) mass spectra in anti pp annihilation reactions at moderate energies are commonly observed to have a central mass value in the range 740 to 755 MeV. A similar result is obtained for rho/sup +-/ mass spectra. An estimate is made of a distortion of the true rho shape which can occur if the rho is emitted as one step in the sequential decay of a massive fireball of hadronic matter. The essential point is that in the emission of a rho meson in the decay chain there are transitions in which energy conservation forbids the emission of the higher mass of the rho Breit-Wigner. (JFP)

18444 (BNL-20148) BOUND STATES AND RESONANCES OF THE NUCLEON-ANTINUCLEON SYSTEM. Dover, C. B. (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1975. 55p. (CONF-750547-2). Dep. NTIS $5.75.

From 4th international symposium on NN interactions; Syracuse, New York, USA (2 May 1975).

An approach to the problem of the nucleon-antinucleon bound states and resonances is discussed using the familiar concepts of nonrelativistic potential theory. Included are the theoretic framework, qualitative features of the N anti N potential, energy spectra of bound states and resonances, the problem of widths, a preliminary comparison of theory and experiment, bound states of heavier systems, and open questions. (JFP)

18445 MODEL INDEPENDENT METHOD OF THE X^0 (960) MESON SPIN PARITY DETERMINATION. Kiosinski, J.; Rembielinski, J.; Tybor, W. (Univ., Lodz, Poland). Ann. Phys. (Leipzig); 31: No. 4, 335-337(Nov 1974).

To establish the X^0 (960) meson spin parity it is suggested to study the correlation between the production process $K^-{}^4He \rightarrow X^0{}_\Lambda{}^4H$ and the decay process $X^0 \rightarrow \eta 2\pi$. (auth)

18446 POSSIBLE NATURE OF THE Ψ PARTICLES. Komar, A.A. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 21: No. 5, 141-143 (5 Mar 1975).

Assuming that the ψ particles are combinations of p' and $\bar{p}'$ quarks, an explanation is offered for the observed characteristics of these particles. The masses of bosons containing one p' quark are estimated. (auth)

18447 ON THE NUMBER OF SOLUTIONS TO A CROSSING SYMMETRIC NEUTRAL π-π MODEL. Brander, O. (European Organization for Nuclear Research, Geneva (Switzerland)). Commun. Math. Phys.; 40: No. 2, 97-124(Feb 1975).

The positivity conditions, derived previously seem to be not sufficient to fix the $\pi^0\pi^0$ S wave with very little additional information. This latter result is strengthened by determining the multiplicity of the exact solution to a crossing symmetric neutral π-π model. One considers only the S wave, but the multiplicity would increase by the addition of other coupled channels. The analysis is not confined to weak coupling only, and includes all solutions, in particular also a class of logarithmically decreasing ones, which are left out by most others. (GE)

18448 HADRON RESONANCES AND LIGHTLIKE CHIRAL ALGEBRA. Ida, M. (Kyoto Univ., (Japan). Research Inst. for Fundamental Physics). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1521-1540(May 1974).

Problems concerning hadron resonances are investigated under two basic assumptions, lightlike chiral algebra $SU(3)_l$ $SU(3)_l$ and the partially conserved axial-vector current hypothesis. In terms of the partial-wave expansion of lightlike axial charges, two kinds of supermultiplets (chiral and $SU(6)_l$-like) and their mixing are considered. Analyses of various pionic decays of mesons are made together with the study of the meson spectrum. They imply the usefulness of lightlike chiral algebra in finding new regularities of hadron resonances. (auth)

18449 RELATIVE HADRONIC WIDTHS OF THE PSI-MESONS AND PSI → D ANTI D → HADRONS. Toernqvist, N. A. (CERN, Geneva). Lett. Nuovo Cim.; 13: No. 9, 341-345(28 Jun 1975).

A natural mechanism, within the charm model, by which one can understand the rapidly growing widths of the Ψ particles with increasing mass is discussed. The predicted ratios for the widths to normal hadrons normalized to the widths of Ψ (3.1) are given for Ψ (4.1), Ψ (3.7), and Ψ (3.1). (JFP)

18450 COHERENT RHO-MESON PHOTOPRODUCTION IN NUCLEI BY MEANS OF JASTROW CORRELATED WAVE FUNCTIONS. Oset, E. (State Univ. of New York, Stony Brook). Lett. Nuovo Cim.; 13: No. 9, 327-333(28 Jun 1975).

Vector meson photoproduction processes are studied where the produced particle is multiply scattered by nucleons. The role of nuclear short-range correlations is of particular interest. The photoproduction is considered under the hypothesis of vector meson dominance. Helium-4 and oxygen-16 are considered as targets. The cross sections are plotted. (JFP)

18451 ANOTHER MECHANISM FOR THE PRODUCTION AND DECAY OF THE NEW NARROW RESONANCES. Nuyts, J. (Univ. of Mons, Belg.). Lett. Nuovo Cim.; 13: No. 9, 323-326(28 Jun 1975).

Another possibility is pointed out for a mechanism for the production and decay of the new narrow resonances. A generalization of a previous GIM mechanism is used. Denoting the four quarks as $\Phi \equiv (p', p, n, \lambda)$ of which p' and p have the same charge q and n and λ the charge q-1, it is shown that it is possible to prevent a weak (nλ) transition thus forbidding the unwanted $\Delta Y = 1$, $\Delta Q = 0$ reactions while preserving a (p', p) transition allowing a $\Delta C = 1$, $\Delta Q = 0$ reaction. It is emphasized that if this mechanism is correct the new particle is a hadron and could be produced copiously in associate production, which its rate to be produced singly in strong interactions could at best be semi-strong. (JFP)

18452 HADRON MASS FORMULAE IN A CHARMED-QUARK MODEL. Lichtenberg, D. B. (Indiana Univ., Bloomington). Lett. Nuovo Cim.; 13: No. 9, 346-350(28 Jun 1975).

Baryon and meson mass formulas are considered in a simple quark model which contains a charmed quark in addition to the usual three quarks. These quarks are taken to be the basis for a broken SU(4) symmetry. The motivation for considering this model is the recent discovery of heavy mesons interpreted as bound states of a charmed quark and its antiquark. (JFP)

Strong (Baryon No. = 1)

18453 (COO-3244-44) STUDIES ON ANTIPROTONIC ATOMS. Eisenstein, R. A. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry). 1975. 9p. (CONF-750547-8). Dep. NTIS $4.00.

From 4th international symposium on NN interactions; Syracuse, New York, USA (2 May 1975).

The discussion of antiprotonic atoms covers exotic atoms, experimental results, analysis and interpretation of these results, and antiprotonium. (JFP)

18454 (JEN-294) TRANSVERSITY AMPLITUDE ANALYSIS FOR $K^-p \rightarrow \pi^- Y^{*+}$ (1385) AND $K^-p \rightarrow \rho^- Y^{*+}$ (1385) FROM EXPERIMENTAL DATA. Barreiro Alonso, F. (Junta de Energia Nuclear, Madrid (Spain). Div. de Fisica). 1975. 152p. (In Spanish). Dep. NTIS (US Sales Only) $10.75.

One deals in this study with the reconstruction, in a model independent way, of the transversity amplitudes describing the hypercharge exchange processes $K^-p \rightarrow \pi^- Y^{*+}$ (1385), Y^{*+} (1385) → $\Lambda\pi^+$, $\Lambda \rightarrow p\pi^-$, and $K^-p \rightarrow \rho^- Y^{*+}$ (1385), $\rho^- \rightarrow \pi^-\pi^0$, Y^{*+} (1385) → $\Lambda\pi^+$, $\Lambda \rightarrow p\pi^-$. (auth)

18455 (USIP-74-26) FACTORIZATION IN THE INCLUSIVE REACTIONS $pp \rightarrow \Lambda + X$ AND $K^+p \rightarrow \Lambda + X$. Alpgard, K.; Frodesen, A. G.; Hagman, V-M.; Hulth, P. O.; Svedin, U.; Villanen, P.; Yamdagni, N. (Stockholm Univ. (Sweden). Fysiska Institutionen). Nov 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

A test of factorization is made using data on the inclusive reactions $pp \rightarrow \Lambda + X$ at 19 GeV/c and $K^+p \rightarrow \Lambda + X$ at 16 GeV/c incident momentum. In these reactions Λ production occurs dominantly via proton fragmentation, and their comparison shows that the factorization hypothesis is well satisfied. (auth)

18456 CONVERGENT PERTURBATION EXPANSIONS AND ANALYTICITY PROPERTIES IN STATIC FIELD-THEORETIC MODELS. Alvarez-Estrada, R. F. (CERN, Geneva). Nuovo Cim.; 27A: No. 1, 37-59(1 May 1975).

Simplified field-theoretic models, consisting of a charged-pion field coupled linearly and quadratically to a fixed extended nucleon

with spin and isospin, are considered. For small couplings it is shown that perturbation theory converges and yields the dressed one-nucleon states and the resolvent of the total Hamiltonian for complex energy. The elastic-scattering and one-pion production amplitudes are shown (i) to be analytic functions of the respective complex energies and (ii) to be given by convergent perturbation expansions in certain regions of the associated complex energy planes. (auth)

18457 IMPACT-PARAMETER DEPENDENCE AND UNIVERSALITY OF THE SHORT-RANGE PART OF π–N PARTIAL WAVES. Lyberg, M. D. (Niels Bohr Inst., Copenhagen). Nuovo Cim.; 27A: No. 1, 73-84(1 May 1975).

The equivalent elastic phases for pion-nucleon scattering have been calculated. They show an unexpected universality as functions of the impact parameter. This implies that the short-range interaction in the physical partial waves is to a large extent independent of isospin, orbital angular momentum and the orientation of the nuclear spin, and depends on the impact parameter only. (4 figures, 1 table) (auth)

18458 URBARYON REARRANGEMENT AND BREAKING OF LINE REVERSAL RELATIONS, 2. Matsuoka, T.; Sawada, S. (Nagoya Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 1, 184-195(Jul 1974).

Some behavior of the breaking of line reversal symmetry of meson–baryon scattering can be qualitatively understood from a viewpoint that the H-type and X-type urbaryon rearrangements are caused by attractive and repulsive interactions, respectively. The strength and range of the interactions which reproduce the experimental energy dependence of the breaking of line reversal symmetry agree with those of the forces constructing recurrences of observed baryon resonance. This result suggests that the interactions which cause the rearrangement of urbaryons are identical with the constructive forces of hadrons. By use of these parameters of the attractive potential, the amplitude corresponding to the H-type urbaryon rearrangement which shows peripheral behavior in the impact parameter representation is obtained. (auth)

Strong (Baryon No. ≥ 2)

18459 (ANL/HEP/PR-75-32) DEVELOPMENTS IN THE PHENOMENOLOGY OF TWO-TO-THREE PARTICLE REACTIONS. Berger, E. L. (Argonne National Lab., Ill. (USA)). Jul 1975. 51p. Dep. NTIS $5.75.

Recent progress in understanding data on two to three particle hadron reactions is described. The use of an s-channel azimuthal angle selection is advocated to identify and separate different exchange mechanisms which contribute to the same final state at low subenergy. Solutions to the neutral Q cross-over problem in the Deck model are discussed, and experimental tests are proposed. Methods are offered for enhancing resonance signals in the presence of a large Deck exchange background. The need for absorptive corrections to the usual Deck model is stressed in the light of new FNAL data on diffractive neutron dissociation and ISR data on proton dissociation. Results of an explicit absorbed pion exchange Deck model calculation are compared with data. (auth)

18460 DIRECT RECONSTRUCTION OF THE pp SCATTERING MATRIX BELOW 500 MeV, AN ATTEMPT. Giffon, M. (Univ., Lyon). Nuovo Cim.; 27A: No. 1, 85-105(1 May 1975).

Whether or not it is possible to use available experimental data to directly reconstruct the pp scattering matrix is explored in three energy ranges extensively searched by experimentalists. It is shown that one can reasonably solve this problem in spite of its complexity and the lack of some data. (4 tables, 5 figures) (auth)

18461 RELATIVISTIC PSEUDOPOTENTIAL EQUATION FOR MULTICHANNEL BARYON–BARYON SCATTERING. Gersten, A. (Univ. of the Negev, Beersheba, Israel); Verhoeven, P. A.; de Swart, J. J. Nuovo Cim., A; 26A: No. 4, 375-395(21 Apr 1975).

The approximation to the Bethe-Salpeter equation of Blankenbecler and Sugar, and Logunov and Tavkelidze is applied to the multichannel spin-$^1/_2$ baryon-baryon interactions. Formulas for the one-boson exchange potentials are given. It is discussed how to use the formalism when some or all channels are closed. (auth)

18462 ELASTIC BACKWARD *pd* SCATTERING AT HIGH ENERGIES. Karmanov, V.A. (Institute of Theoretical and Experimental Physics, USSR Academy of Sciences). JETP Lett. 21: No. 5, 132-134 (5 Mar 1975).

The cross section for backward *pd* scattering was calculated in the proton kinetic energy interval from 0.316 to 2.5 GeV within the framework of the pole mechanism, with the relativistic character of particle motion taken into account. The effect of parametrization of the deuteron wave function in relativistic coordinate space is investigated. (auth)

18463 SHADOW OF PION EXCHANGE AT HIGH ENERGY. White, J. N. P. (Max-Planck-Inst. fuer Physik und Astrophysik, Munich). J. Phys., G (London); 1: No. 4, 400-414(5 May 1975).

An investigation of the shadow of pion exchange and its contribution to the proton-proton total cross section $\Delta\sigma_T$ and forward elastic slope is made through an analysis of high energy small momentum transfer behaviour of the absorptive part of the Feynman box graph generalized to include either resonance or continuum intermediate states and off-mass-shell form factors. In order that $\Delta\sigma_T$ be nonvanishing it is necessary to sum up all final states from at least one of the protons. With one such summation, $\Delta\sigma_T$ is of order 2 to 3 mb and hardly increases with energy. The corresponding slope is too small to explain the large experimental value. With both final states summed $\Delta\sigma_T$ increases like lg s (and can account for the rise in σ_T) and the resulting slope is essentially twice the πp elastic slope measured at low energy. (auth)

18464 GEOMETRICAL CORRECTIONS TO THE GLAUBER MULTIPLE-SCATTERING THEORY. Obu, M. (Nihon Univ., Tokyo. Coll. of Science and Engineering). Progr. Theor. Phys. (Kyoto); 52: No. 1, 170-183(Jul 1974).

If used without any small-angle approximations, the multiplicity of the S matrix is pointed out to provide a geometrical generalization of the additivity of the phase shift which is usually written in the impact-parameter representation. On the basis of this multiplicative law a multiple-scattering formalism is developed which is a direct geometrical generalization of the ordinary Glauber formalism. With the use of the generalized theory geometrical corrections to the Glauber theory are evaluated for two examples, double scattering of ~10 GeV/c protons and pions by deuterons and elastic scattering of 1 GeV protons by ^{4}He. It is emphasized that the calculation by the generalized theory is of much significance especially when done in parallel with the ordinary theory. (auth)

18465 LARGE-ANGLE AND FORWARD SCATTERINGS IN THE RELATIVISTIC EIKONAL APPROXIMATION. Doi, M.; Kotani, T. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 6, 1865-1873(Jun 1974).

Theoretical expressions for large-angle and forward elastic scatterings of two nucleons at high energies are derived in the eikonal formalism. On the basis of field theory and the functional derivative method, two kinds of s-channel crossed ladder diagrams are considered. It is shown that the large-angle scattering amplitude takes a form similar to DWBA, and the forward amplitude includes the higher order correction to the well known Glauber approximation. These correction terms are proportional to the square of momentum transfer. (auth)

18466 COVARIANT DYNAMICAL CALCULATION OF THE NUCLEON-NUCLEON *S* WAVES. Brayshaw, D.D. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Noyes, H.P. Phys. Rev. Lett. 34: No. 25, 1582-1585 (23 June 1975).

We compute the binding energy of the $^3S_1$ and $^1S_0$NN states (known to be bound by 2.22 and −0.07 MeV) using a covariant, singular-core, three-body model of the NNπ system with r_c^{NN}=0.7 fm, $^3f_\infty$=1.8, and $^1f_\infty$=0.3 as observed at high energy. For the πN P_{11} input we use $r_c^{\pi N}$=0.18 fm fitted (or $\hbar$/Mc=0.22 fm postulated) and find 3.26 (2.59) for $^3S_1$ and 1.41 (0.73) for $^1S_0$. (auth)

18467 THRESHOLD PION PRODUCTION IN PION-NUCLEUS COLLISIONS: A SIMPLE ESTIMATE. Rockmore, R. (Physics Department, Rutgers, The State University, New Brunswick, New Jersey 08903). Phys. Rev. C 11: No. 6, 1953-1958 (June 1975).

The Goldhaber-Teller model generalized to spin-isospin vibrations is used to provide a simple estimate for the total cross section for threshold pion production in pion-nucleus collisions ($\pi^- A_z \to \pi^- \pi^+ A_{z-1}$) in the case of nuclei with $N = Z$. Cross sections are calculated using the threshold approximant to the production amplitude for single nucleons consisting of pion pole plus contact terms alternately derived from the phenomenological Lagrangian theory and the current-commutator theory of multiple-pion production. The threshold approximant in the latter theory fits the experimental pion-production data on protons poorly and, in the case of ^{4}He, the lightest target nucleus we consider, that theory predicts cross sections about a factor of 2 smaller than those similarly calculated with phenomenological Lagrangian input. On the other hand, for ^{12}C and ^{16}O, the predictions of the alternative threshold theories are in essential agreement. In the case of the current-commutator theory, the Goldhaber-Teller predictions for ^{4}He and ^{16}O are consistent with those of the particle-hole model obtained earlier by Eisenberg after quadrupling his calculated values to compensate for an omitted factor of 2 in his production amplitude.

While the cross sections for the $(\pi,2\pi)$ reaction in nuclei are still expected to be quite small, the prospect for their accessibility seems reasonably improved. (auth)

Particle Invariance Principles and Symmetries

General

18468 (IAE-2317) CLEBSCH-GORDAN COEFFICIENTS OF IRREDUCIBLE REPRESENTATIONS OF THE CLASS 1 SO(n)-GROUP AND OF IRREDUCIBLE REPRESENTATIONS OF THE CLASS 2 SU(n)-GROUP. Kil'dyushov, M. S.; Kuznetsov, G. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 15p. (In Russian). INIS.

Formulas for the subject coefficients were obtained by a derivative method. (tr-auth)

18469 STRANGE CURRENTS AND THEIR DIVERGENCIES IN CHIRAL SU(2) × SU(2) DYNAMICS. Kapustnikov, A. A. (Dnepropetrovsk State Univ., USSR). Yadern. Fiz.; 21: No. 3, 662-663(Mar 1975). (In Russian).

The simplest equation for divergencies of the strange currents is postulated in framework of the nonlinear realization of the chiral SU(2) × SU(2) symmetry. An expression for the model Lagrangian satisfying this equation is obtained. (auth)

Applications (Strong)

18470 NARROW MESONS AND COLOR SYMMETRY. Volkovitskii, P.E.; Zakharov, V.I.; Kaidalov, A.B.; Okun', L.B. (Institute of Theoretical and Experimental Physics, USSR Academy of Sciences). JETP Lett. 21: No. 5, 136-138 (5 Mar 1975).

We consider the consequences of the assumption that the recently discovered narrow resonances are colored particles and the representatives of the *SU* (3) color group octet. (auth)

Scattering Theory

Refer also to abstracts 18520, 18683, and 18700.

18471 (CONF-720133-1) IV BRAZILIAN SYMPOSIUM ON THEORETICAL PHYSICS. Volume III. Pade Approximants and Applications. Ferreira, E. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). 1972. 65p. Dep. NTIS (US Sales Only) $6.25.

From 4th symposium on theoretical physics; Rio de Janeiro, Brazil (4 Jan 1972).

The conference on theoretical physics covers the definition and some properties of Pade approximants, linear integral equations with kernels of finite rank, the reduced matrix problem, Pade approximants and variational methods, and applications to the study of cooperative phenomena and critical points, to potential scattering, and to the strong interactions of elementary particles. (JFP)

18472 PHASE SHIFTS FOR THE GAUSS AND MECKE-SUTHERLAND POTENTIAL FUNCTIONS. Sharma, L. K.; Singh, F.; Varma, R. C. (Government Engineering Coll., Rewa, India). Indian J. Phys.; 48: No. 9, 826-832(Sep 1974).

Scattering phase shifts for the radial Schrödinger equation under the Gauss and Mecke-Sutherland potential energy functions have been evaluated, using the relations established by Tietz. A particular case of the latter potential function has also been discussed. (auth)

18473 THEORY AND PHENOMENOLOGY IN HIGH ENERGY $2 \rightarrow 2$ SCATTERING. Leader, E. (Westfield Coll., London). pp 367-456 of Proceedings of the Canadian Institute of Particle Physics Summer School. Henzi, R. (ed.). Montreal; Inst. of Particle Physics (1973).

From Canadian Institute of Particle Physics summer school; Montreal, Quebec (27 Aug 1973).

The main features of $2 \rightarrow 2$ scattering at high energies and the relation to the partly successful theoretical models are summarized. The work concentrates on meson-baryon and baryon-baryon scattering at small angles, that is $t = 0$ and $-1 < t < 0$. A look at Regge pole theory and SU(3) along with the absorption model is given in order to predict the results. (MGH)

18474 POTENTIAL DESCRIPTION OF THE VN-NNθ SECTOR OF THE LEE MODEL. Dillon, G.; Giannini, M. M. (Univ., Genoa). Nuovo Cim.; 27A: No. 1, 106-118(1 May 1975).

The VN-NNθ sector of the Lee model is studied by making use of the clothing-transformation technique. The space is decomposed in two uncoupled orthogonal subspaces and the Hamiltonian expressed in the clothed basis is the sum of the VN and NNθ interactions. We obtain all the elastically equivalent potentials which give the correct on-shell θNN scattering amplitude and find that they are necessarily three-body potentials. The limit of infinite coupling constant and infinite internal energy of the V-particle is also discussed. (auth)

18475 FORMULA FOR REGGE RESIDUES IN TERMS OF TRAJECTORIES AND PHASE SHIFTS. Abbe, W. J. (Univ. of Georgia, Athens). Nuovo Cim., A; 26A: No. 4, 396-413(21 Apr 1975).

The asymptotic behavior for large $z = \cos\theta$ is derived for a recent analytic continuation of the scattering amplitude in potential theory and is shown to be consistent with Regge behavior. This leads to a new formula for the Regge residues in terms of trajectories with Re $\alpha_n > -\frac{1}{2}$ and real physical phase shifts. The residues are approximately compared with exact results in potential theory and asymptotic limits discussed. (auth)

18476 DUAL PROPERTIES OF DAMA. Enkovskii, L. L. (Inst. of Theoretical Physics, Kiev). Yadern. Fiz.; 21: No. 3, 645-654(Mar 1975). (In Russian).

Dual properties of amplitudes with Mandelstam analyticity (DAMA) are studied. (1) Using duality the restrictions on the Regge trajectories are obtained; (2) the realization of duality in a model with broad resonances is studied. (auth)

18477 ESTIMATE OF THE TOTAL OPE CONTRIBUTION TO THE INELASTIC CROSS-SECTION OF A pp-COLLISION. Kuchin, I. A. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 29-32 (1974). (In Russian).

Using a model of a Regge single pion exchange, the cross section of inelastic proton-proton interaction with activation of one and two nucleons was calculated. It was shown that with pulses from 1 to 70 GeV/sec the total cross section of these processes decreased from 28 to 15 mb. (tr-auth)

18478 PROCEDURE FOR CALCULATING RESONANCE EIGENVALUES. Doolen, G. D. (Texas Agricultural and Mechanical Univ., College Station). J. Phys., B (London); 8: No. 4, 525-528(11 Mar 1975).

Although several authors have shown that for an exact calculation the resonance pole locations do not move after a coordinate rotation has exposed the pole, a detailed study has previously not been reported for physical models of the dependence of the pole locations on rotation angle, basis set size, and nonlinear parameters in the basis set. Such a study is carried out, which indicates a procedure that can be used to locate resonances accurately and efficiently. (auth)

18479 THE STRUCTURE THEOREM IN S-MATRIX THEORY. Iagolnitzer, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Commun. Math. Phys.; 41: No. 1, 39-53(Mar 1975).

A basic tool in the derivation of multiparticle discontinuity formulas in S-matrix theory is a "structure theorem" which proves analyticity properties for integrals of products of scattering function. Some recent mathematical results are presented, and it is shown how they provide directly a general form of this theorem. This new proof, which removes an unnecessary technical assumption of the previous ones, is a development of a method proposed by Pham. (auth)

18480 THE THREE-BODY TIME-DELAY OPERATOR. Osborn, T.A. (Department of Physics, Brooklyn College, Brooklyn, New York 11210); Bollé, D. J. Math. Phys. (N.Y.) 16: No. 8, 1533-1549 (Aug 1975).

Using Faddeev's form of time-dependent scattering theory, we give an abstract definition of time delay valid for multichannel scattering. For the three-body scattering problem we find an explicit relation, that is valid on the energy shell, between the time-delay operator and the S operators and their energy derivatives. (auth)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

Refer also to abstract 18380.

18481 (MLM-2202) SUPERFLUID ^{3}He: A DESCRIPTION OF TWO RECENTLY DISCOVERED PHASES. (Mound Lab., Miamisburg, Ohio (USA)). 16 Jun 1975. Contract AT-33-1-GEN-53. 21p. Dep. NTIS $4.00.

Research on ^{3}He at very low temperatures is a vigorous and expanding field. Two years ago, two new phases of ^{3}He were discovered at very low temperatures (about 0.002 degree above absolute zero). These phases have become known as anisotropic superfluids. A description is given here of some of the experimental evidence for the new phases and a simplified form of the theoretical model is presented. (9 figures, 25 references) (auth)

18482 EXCITON-LIKE EXCITATIONS IN LIQUID HELIUM. Gvozdikov, V. M.; Fal'ko, I. I. (Kharkov State Univ.). Izv. Vyssh. Ucheb. Zaved., Fiz.; No. 6, 64-67(1974). (In Russian).

On the basis of a model representation of the structure of liquids, the energy spectrum of elementary excitations in superfluid He was obtained. It was shown that the spectrum consists of two branches: the Landau–Feynman branch and a new branch located above the Landau–Feynman branch. Its central part was observed experimentally by Iwamoto. (tr-auth) (4 figures)

18483 KINETICS OF VORTEX PUMPING IN OSCILLATING HELIUM II. Kiknadze, L. V.; Mamaladze, Yu. G. (Institut of Physics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 77: No. 2, 337-340(Feb 1975). (In Russian).

Relatively simple differential equations are suggested giving a qualitatively good description of complicated processes of vortex formation, decay and annihilation. (auth)

18484 SPIN HYDRODYNAMICS OF ^{3}He IN THE ANISOTROPIC A PHASE. Graham, R.; Pleiner, H. (Institut fuer Theoretische Physik der Univ., Stuttgart). Phys. Rev. Lett.; 34: No. 13, 792-795(31 Mar 1975).

The linearized hydrodynamics of spin motion in A-^{3}He is derived from the broken symmetries and thermodynamics alone. Spin and diffusion modes are obtained without and with spin–orbit coupling and an external magnetic field. (auth)

18485 A NEW SINGULARITY IN THE DISPERSION OF IMPURITY EXCITATION IN SUPERFLUID HELIUM. Esel'son, B.N.; Slyusarev, V.A.; Sobolev, V.I.; Strzhemechnyi, M.A. (Physicotechnical Institute for Low Temperatures, Ukrainian Academy of Sciences). JETP Lett. 21: No. 5, 115-116 (5 Mar 1975).

It is shown that the impurity branch of the energy spectrum of the elementary excitations of He^3–He^4 solutions has an end point at which decay into a roton and an He^3 quasiparticle with small momentum takes place. The parameters of this spectrum are obtained. (auth)

18486 SUPERFLUID HELIUM IN A RESTRICTED GEOMETRY. Frankel, N. E. (Melbourne Univ., Parkville, Australia). J. Phys., C (London); 8: No. 9, 1357-1361(7 May 1975).

A set of boson models, incorporating an excitation spectrum which produces a linear relation between the temperature and the superfluid density in narrow channels at low temperatures as seen by Pobell et al. (Phys. Rev. Lett.; 28: 542 (1972)), are presented. These energy states are interpreted as arising from adatom-substrate interactions resulting from the heterogeneity of the surface. (auth)

18487 TUNNEL JUNCTION INVESTIGATIONS OF SUPERFLOW IN THIN HELIUM-4 FILMS. Long, A. R. (Cambridge Univ., Eng.). J. Phys., C (London); 8: No. 9, 1349-1356(7 May 1975).

Preliminary investigations are reported of superflow onset and third-sound velocity made using superconducting tunnel junction transducers in the temperature range 0.85 to 1.05 K, a technique of comparable, if not superior, sensitivity to any used before. Several novel effects have been observed, notably a discontinuous variation of superfluid density with film thickness, interpreted as reflecting a change of state in the helium film, and also finite resistance to DC film flow above the conventional onset point. The technique promises to be of significant importance in future investigations of superflow in the < 1 K range. (auth)

Superconductivity

Refer also to abstracts 17775, 17779, 17796, 17815, 17824, 17828, 17832, 17843, 17844, 17847, 17848, 17870, 17891, and 17898.

18488 (COO-1569-128) ORDER PARAMETER FLUCTUATIONS AND COLLECTIVE MODES IN SUPERCONDUCTORS. Carlson, R. V. (Minnesota Univ., Minneapolis (USA). Dept. of Physics and Astronomy). Jun 1975. 199p. Dep. NTIS $13.00. Thesis.

Measurements of the frequency and wave vector dependence of the pair-field susceptibility and the dynamical structure factor of homogeneous, short mean free path aluminum films have been carried out. These measurements critically probe the dynamical nature of order parameter fluctuations in the vicinity of the superconducting phase transition. Two important results are found. The first is that at temperatures higher than the transition temperature of the aluminum film, the fluctuations of the order parameter can be described by a diffusive time-dependent generalization of the Ginzburg-Landau equation. Detailed comparison of the data to the results of theoretical calculations of Scalapino, and Shenoy and Lee are carried out. Except in the immediate vicinity of the transition, there is excellent agreement with the theories. A major discrepancy between theory and experiment does exist in the vicinity of the superconducting transition, in that the pair relaxation frequency falls well below the theoretical predictions. Possible explanations of this behavior are discussed. Below the transition temperature measurements of the structure factor (Fourier transform of the order parameter-order parameter correlation function) provide the first clear cut demonstration of the existence of a propagating, low frequency, order parameter collective mode which appears as a finite frequency peak in the structure factor. This mode has been identified with fluctuations in the phase of the order parameter and has a linear dispersion relation over the range in which it is observed. A detailed comparison to some of the theoretical explanations is made, with the conclusion that at this time, existing theories do not adequately explain the behavior of the mode over the range of temperature and magnetic field in which it is observed. (43 figures, 4 tables, 86 references) (auth)

18489 (JUL-1149-FF) CALCULATION OF THE VORTEX STRUCTURE AND THE SUBCRITICAL FIELDS OF TYPE II SUPERCONDUCTORS AT ANY TEMPERATURE AS A FUNCTION OF THE FREE PATH LENGTH. Kramer, L.; Pesch, W.; von Seggern, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Dec 1974. 88p. (In German). Dep. NTIS (US Sales Only) $7.50.

The method used previously to solve Eilenberger's version of the Gorkov equations for vortices in type II superconductors at arbitrary temperature is described in detail. Some new results including the lower critical field for intermediate mean free path are presented and printouts of the computer programs are added. (5 figures) (auth)

18490 BCS-MODEL IN PERTURBATION THEORY. Nieminen, I. (Eidgenoessiche Technische Hochschule, Zurich). Helv. Phys. Acta; 47: 731-748(1974).

The BCS-model for superconductivity is investigated in the perturbation theory. The partial sum over ladder graphs in the quantum statistical perturbation expansion for the reduced density matrix (RDM) is examined for the case n = 2 (two particles created and two annihilated). It is shown that this partial sum can be simplified to a sum of three geometrical series. These converge absolutely at high enough temperatures for any coupling strength. At low temperatures the expansion diverges for attractive potentials, when the total momentum of the particle pair approaches zero, however weak the coupling may be. If the coupling is weak enough the expansion also converges at low temperatures when the total momentum of the pair differs sufficiently from zero. Thouless' result is gotten also that from this theory one can define a critical temperature which for the BCS-potential leads to the familiar equation for the critical temperature in the BCS-theory. (auth)

18491 DIPOLARONS OF THE INTERMEDIATE COUPLING AND SUPERCONDUCTION OF NON-METAL CRYSTALS. Vinetskii, V. L.; Semenets, T. I. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 3, 353-359(Mar 1975). (In Russian).

It is shown that in the region of intermediate and strong electron coupling with the lattice polarization vibrations there exists stable and metastable bipolarons — mobile localized pairs of current carriers. The appearance of the second kind superconduction should be expected with the Bose-condensation of bipolarons. (1 figure) (auth)

18492 DUALITY AND RECIPROCITY FOR THE NON-LINEAR EQUATIONS OF HEREDITARY ELECTROMAGNETISM. Fabrizio, M. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Nat.; 55: No. 5, 420-428(Nov 1973). (In Italian).

Some duality formulas relative to the equations of the electromagnetism were formulated for materials with memory. These theorems were applied to establish the electric field emitted by an antenna parallel to a surface of a superconductor. (tr-auth)

18493 ELECTRODYNAMICALLY AND THERMALLY DRIVEN FLUX FLOW IN TYPE I SUPERCONDUCTORS. Lerski, R. A. (Saint Andrews Univ., Eng.). J. Phys., F (London).; 5: No. 5, 923-938(May 1975).

A high resolution magneto-optic method employing Eu:EuF_2 films has been used to observe directly the dynamic intermediate state induced by the passage of an electric current or a heat current through thin slabs of the superconductors Pb, In and An. The observed flux flow velocities have been compared with and show reasonably good agreement with recent theoretical work by Andreev and Dzhikaev if allowance is made for the effects of pinning. A detailed examination has been made of the region close to the critical current in the electric current induced motion. In the case of the thermally induced motion the existence of two competing mechanisms driving the flux, as was recently suggested by Laeng and Rinderer, has been confirmed. Comparison has been made with theoretical models, again with some agreement and some disagreement. (auth)

18494 EVALUATION OF CORRELATION FUNCTIONS IN THE CASE OF THE DEGENERATE STATISTICAL EQUILIBRIUM STATE. Tserkovnikov, Yu. A. (Mathematics Inst., Moscow). Teor. Mat. Fiz.; 23: No. 2, 221-237(May 1975). (In Russian).

A general procedure for constructing the solutions of systems of equations for normal and anomalous correlation functions is developed. Approximate solutions valid in the whole time interval from t = 0 to infinity are found in general form. For the case of the superconductive model based on the Fröehlich Hamiltonian, the energy of elementary excitations and damping are calculated and asymptotic expressions for correlation functions at large and small values of the time are obtained. (auth)

18495 COMPLETE SOLUTION OF NEW SUPERCONDUCTING CURRENT STATE ABOVE THE CRITICAL CURRENT. Fink, H. J.; Poulsen, R. S. (Univ. of California, Davis). Phys. Rev., B.; 11: No. 5, 1870-1877(1 Mar 1975).

A complete set of exact solutions of a new superconducting state is presented for the one-dimensional case. The order parameter PSI is periodic in space and stable in time for spatial periods long compared to the coherence length. These solutions have critical currents which are larger than the usually accepted critical current I/sub c/ but with the addition of dc electric fields inside the superconductor which are generated by phase slippage of the order parameter at points where PSI equals 0. At these points the complex order parameter has a discontinuous gradient and its real amplitude a continuous gradient. Spatially periodic super and normal dc currents coexist in the superconductor simultaneously. These solutions give rise to voltage steps in the dc voltage-current characteristics for currents I/sub T/ larger than I/sub c/, but may in principle also exist for I/sub T/ less than I/sub c/ if the condition of lowest energy is waived. A critical value of a parameter P equals P/sub c/ is calculated below which the material cannot have superconducting states for I/sub T/ greater than I/sub c/. P is inversely proportional to the normal-state resistivity and relaxation time tau of the superconductor. P can be determined from experiments and from it, tau calculated. (auth)

PHYSICS (NUCLEAR)

Neutron Interactions with Matter

Refer also to abstracts 18671 and 18749.

18496 (CNAEM-R-132) MODELED THEORY OF PULSED-NEUTRON EXPERIMENTS IN FAST SUBCRITICAL ASSEMBLIES. Adalioglu, U.; Duderstadt, J. J. (Cekmece Nuclear Research and Training Center, Istanbul (Turkey)). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The time behavior of a neutron pulse in a fast subcritical assembly is modeled by approximating the spatial dependence by a single diffusion mode and using a simple model of inelastic scattering. This model allows an explicit calculation of the time response of a detector in such a system. Of particular interest is a study of the detector response in those situations in which the flux does not decay in an exponential fashion. (7 figures, 2 tables) (auth)

18497 (CONF-750545-1) HETEROGENEITY EFFECTS IN NEUTRON TRANSPORT COMPUTATIONS. Gelbard, E. M. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-38. Dep. NTIS $4.75.

From symposium on the numerical solution of partial differential equations; College Park, Maryland, USA (19 May 1975).

A nuclear reactor is, generally, an intricate heterogeneous structure whose adjacent components may differ radically in their neutronic properties. The heterogeneities in the structure of the reactor complicate the work of the reactor analyst and tend to degrade the efficiency of the numerical methods used in reactor computations. Two types of heterogeneity effects are considered. First, certain singularities in the solution of the neutron transport equation, induced by heterogeneities, are briefly described. Second, the effect of heterogeneities on neutron leakage rates, and consequently on effective diffusion coefficients, are discussed. (auth) (5 figures)

18498 (COO-2280-22) COMPUTATIONAL COMPLEXITY IN MULTIDIMENSIONAL NEUTRON TRANSPORT THEORY CALCULATIONS. Progress Report, September 1, 1974–August 31, 1975. Bareiss, E. H. (Northwestern Univ., Evanston, Ill. (USA)). 1975. Contract AT(11-1)-2280. 13p. Dep. NTIS $4.00.

The objectives of the research remain the same as outlined in the original proposal. They are in short as follows: Develop mathematically and computationally founded criteria for the design of highly efficient and reliable multi-dimensional neutron transport codes to solve a variety of neutron migration and radiation problems and analyze existing and new methods for performance. (JFP)

18499 (CTH-RF-28) DECAY CONSTANTS FOR PULSED MONOENERGETIC NEUTRON SYSTEMS WITH ANISOTROPIC SCATTERING. Sjoestrand, N. G. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Reaktorfysik). Mar 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

The eigenvalue equation for monoenergetic neutron transport with linearly anisotropic scattering has been solved numerically. The results are presented in the form of detailed tables and curves. The implications on pulsed neutron moderator experiments are discussed. In spite of sometimes double-valued relationships between decay constant and buckling, it seems possible to interpret the experiments in a unique way through the use of extrapolation lengths. (auth)

18500 (FEI-464) CALCULATION OF NEUTRON PENETRATION IN A SPHERICAL GEOMETRY. Part I. Tsibulya, A. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 19p. (In Russian). INIS.

Algorithms were developed for calculating the passage and the coefficient of sensitivity for passage in a group and subgroup by an approximate Monte Carlo method. Both direct and combined neutron transfer equations were used. Results are given for calculations of passage and coefficients of sensitivity obtained by a program based on the algorithms developed. (tr-auth)

18501 (KFKI-75-21) MONTE CARLO CALCULATED SPECTRA OF NEUTRONS TRANSMITTED THROUGH AND REFLECTED FROM HOMOGENEOUS POLYETHYLENE SLABS. Koblinger, L.; Palfalvi, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Feb 1975). 39p. Dep. NTIS (US Sales Only) $5.25.

Transmission and reflection of 14.5 MeV and fission neutrons are calculated for polyethylene shields of thicknesses from 5 to 40 cm. The 48 group spectra are calculated by the Monte Carlo code 05R5S and plotted by the code TRESSPASS. Characteristic quantities of the spectra, average energies, thermal and fast fractions, as well as the transmission or reflection probabilities are also given. (28 figures, 1 table) (auth)

18502 (LA-5949-MS) NEUTRON SPECTRUM FROM AN ORALLOY SPHERE. Ragan, C. E.; Auchampaugh, G. F.; Hemmendinger, A.; Silbert, M. G. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-ENG-36. 15p. Dep. NTIS $4.00.

The neutron spectrum from a 38-kg oralloy sphere, pulsed by a centrally located 14-MeV neutron source, has been measured using time-of-flight (TOF) techniques. The nearly isotropic source of 14-MeV neutrons was produced by bombarding a tritium gas target with low-energy deuterons. Neutrons in the 0.180- to 15.0-MeV energy range were detected at the end of a partially evacuated, 39-m flight path by a NE-213 liquid scintillator that used pulse shape discrimination to distinguish neutron events from gamma-ray events. Detector thresholds of 0.15 and 0.85 MeV were used to cover the above energy range, and the detector efficiency was measured over this range using monoenergetic neutrons from the T(p,n), T(d,n), and D(d,n) reactions. Several measurements of the TOF spectrum were used to determine the neutron flux at the detector, and a comparison of this flux with the results of Monte Carlo calculations is presented. These calculations were performed with the code MCN using two cross-section sets, those from the Lawrence Livermore Laboratory (LLL) and those from the ENDF/B-IV library. The results calculated using the ENDF/B-IV cross sections are in excellent agreement with the measurements, especially in the 1- to 6-MeV energy region, where the uncertainties in both the calculated and experimental results are the smallest. (5 tables, 15 figures) (auth)

18503 (ORNL-5054) NUCLEAR STRUCTURE DATA FILE. A Manual for Preparation of Data Sets. Ewbank, W. B.; Schmorak, M. R.; Bertrand, F. E.; Feliciano, M.; Horen, D. J. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 34p. Dep. NTIS $4.00.

The Nuclear Data Project at ORNL is building a computer-based file of nuclear structure data, which is intended for use by both basic and applied users. For every nucleus, the Nuclear Structure Data File contains evaluated nuclear structure information. This manual describes a standard input format for nuclear structure data. The format is sufficiently structured that bulk data can be entered efficiently. At the same time, the structure is open-ended and can accommodate most measured or deduced quantities that yield nuclear structure information. Computer programs have been developed at the Data Project to perform consistency checking and routine calculations. Programs are also used for preparing level scheme drawings. (RWR)

18504 (ORNL-TM-4970) FREQUENCY OF OCCURRENCE OF VARIOUS NUCLEAR REACTIONS WHEN FAST NEUTRONS (GREATER THAN OR EQUAL TO 50 MeV) PASS THROUGH TISSUE-EQUIVALENT MATERIAL. Alsmiller, R. G. Jr. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 21p. Dep. NTIS $4.25.

Calculated results are presented for the frequency with which various partial nuclear-reaction cross sections are utilized when fast neutrons (less than or equal to 50 MeV) are transported through a tissue-equivalent phantom to obtain an indication of which cross sections are of most importance for radiotherapy applications and are therefore in need of experimental verification. (6 tables) (auth)

18505 (RT/FIMA-(74)2) SHREDI: A REMOVAL-DIFFUSION SHIELDING CODE FOR x-y AND r-z GEOMETRIES. Daneri, A.; Toselli, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Dec 1974. 53p. Dep. NTIS (US Sales Only) $6.00.

SHREDI is a Removal-Diffusion neutron shielding code, written in FORTRAN for IBM 370/165. This code computes neutron fluxes or adjoint fluxes and activations in bidimensional sections (x,y or r,z) of the shield. It is also possible to consider shielding points with the same y-bar or z-bar coordinate (monodimensional problems). (3 figures) (auth)

18506 (WANL-TME-277) PREPARATION OF THERMAL GROUP CROSS-SECTIONS FOR USE IN THE DSN CODE. Drawbaugh, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 Sep 1962. 5p. Dep. NTIS $4.00.

A consistent and physically justifiable method of constructing thermal group cross sections for use in the DSN code is described. (SDF)

18507 (WANL-TMI-353) PREPARATION OF THERMAL GROUP CROSS-SECTIONS FOR USE IN THE DSN CODE. Revision

of TMI-277. Drawbaugh, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Nov 1962. 9p. Dep. NTIS $4.00.

A more consistent and physically justifiable method of constructing thermal cross sections for use in DSN than the previously used method is described. (SDF)

18508 MONTE CARLO CALCULATIONS OF THE DIFFUSION OF ULTRA COLD NEUTRONS. Winfield, D.; Robson, J. M. (McGill Univ., Montreal). Can. J. Phys.; 53: No. 7, 667-673 (1 Apr 1975).

The intensity of ultra cold neutrons transmitted along a copper tube has been calculated by Monte Carlo techniques and compared with experimental intensities and with pure diffusion theory calculations. The possibility of focussing ultra cold neutrons by using a conical tube is also illustrated by this technique. (auth)

18509 SOLUTION OF FERMI AGE EQUATION IN CYLINDRICAL GEOMETRY. Gupta, K. C. (M. R. Engineering Coll., Jaipur, India); Mathur, S. L. Indian J. Phys.; 48: No. 9, 802-809(Sep 1974).

The problem of slowing down of neutrons in infinite, semi-infinite and finite cylindrical piles, under accurate boundary conditions is considered. The solution of the problem for a finite hollow cylindrical pile has also been obtained. (auth)

18510 DEPENDENCE OF NUMERICAL ALBEDO OF FAST NEUTRONS ON THICKNESS OF IRON SCATTERER. Pozdneev, D. B.; Faddeev, M. A. Sov. At. Energy (Engl. Transl.); 37: No. 3, 989-990(Sep 1974).

Translated from At. Energ. (USSR); 37: No. 3, 266-267(Sep 1974).

Research results are given on the dependence of the albedo of a localized surface region on the thickness of a reflector. Two cases were studied: a point isotropic source located at a point on the reflector surface, and a unidirectional beam of primary neutrons incident perpendicular to the reflector surface at the same point. (GHT)

18511 MAGNETIC MOMENT DENSITIES AND NEUTRON SCATTERING. Balcar, E. (Atominstitut der Oesterreichischen Hochschulen, Vienna). J. Phys., C (London); 8: No. 10, 1581-1594(21 May 1975).

The matrix elements of the spin and orbital magnetic moment density operators are calculated using spherical tensors and Racah algebra. The formulas are derived in the $vSLJM$ basis and supplementary results for the extension to the vSM_SLM_L representation are given. The simple relation between magnetic moment density, scattering operator and intermediate scattering operator is investigated, and a procedure for the transition from the intermediate scattering operator to the magnetic moment density is derived. The results are applied to FeF_2 as a specific example. (auth)

18512 MONTE CARLO CALCULATION OF ULTRA COLD NEUTRON FLOW THROUGH LONG TUBES WITH A REALISTIC ANGULAR DISTRIBUTION OF REFLECTED NEUTRONS. Brown, M.; Golub, R.; Pendlebury, J. M. (Sussex Univ., Brighton, Eng.). Vacuum; 25: No. 2, 61-64(Feb 1975).

Monte Carlo simulations of the flow of particles through tubes are used to study the effects of a theoretically well founded non-specular reflection probability on the transmission of the tubes and the angular distribution of the emerging particles. The theoretical reflection probability used is appropriate for ultra cold neutrons scattering from almost smooth surfaces. The results obtained are compared to those described in earlier work in which approximations to the theoretical reflection law were used. (auth)

18513 BENCHMARK EXPERIMENT OF NEUTRON PROPAGATION IN IRON USED TO TEST ENDF/B CROSS-SECTION DATA. Martini, M.; Palmiotti, G.; Salvatores, M. (CNEN, Rome). Nucl. Sci. Eng.; 56: No. 4, 427-431(Apr 1975).

A benchmark neutron propagation experiment in iron was used to compare experimental and calculated reaction rates to test ENDF/B iron cross sections. A background effect of the manganese impurity, stronger than earlier expected, is shown to play an important role in the assessment of the 25-keV s-wave scattering resonance minimum. The deficiencies in the high-energy (greater than 30 keV) range of ENDF/B-III data, which are also indicated, seem to be overcome by the most recent evaluations. (8 figures) (auth)

18514 DETERMINATION OF PAIR INTERACTIONS FROM NEUTRON INELASTIC SCATTERING DATA. Rahman, A. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. A 11: No. 6, 2191-2193 (June 1975).

Neutron inelastic scattering data from a monatomic liquid can be directly translated into a pair interaction. This requires accurate experimental determination of the zeroth and fourth moments of $S(\kappa, \omega)$. The iterative calculation works because the Fourier transform of the fourth moment gives a good zeroth approximation to the second derivative of the potential. Recent molecular dynamics data on liquid rubidium are used to illustrate the method. Experiments should be carried out to exploit this method. (auth)

18515 THE CORRECTION OF MULTIPLE SCATTERING IN NEUTRON DIFFRACTION BY MEANS OF THE COMPUTER SIMULATION. Nakai, Y. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). Jap. J. Appl. Phys.; 13: No. 7, 1061-1064 (Jul 1974).

The scattering process of neutrons by a crystal including the multiple scattering is simulated by a computer, assuming that the scattering has a rotational symmetry around the normal of a plate-like polycrystalline specimen. The calculated intensities agree well with experimental results, even for iron with a large multiple Bragg scattering. This method is useful in subtracting contributions from multiple scattering from the experimentally observed intensities of diffuse scattering. (auth)

18516 DECAY OF SLOW NEUTRON PULSES IN COLD MODERATORS. Akimoto, T.; Ogawa, Y. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Saito, T. Hokkaido Daigaku Kogakubu Kenkyu Hokoku; No. 72, 125-131(Sep 1974). (In Japanese).

The decay constants of neutrons in methane, ethane and light water at various low temperatures were obtained by experimentation and calculation. A simple method for estimating the cooling limited temperature of neutrons using the decay constant was set forth. The investigation showed that solid methane is a favorable moderating material for a pulsed cold neutron source, judging from the decay constant and the cooling limited temperature of neutrons. (auth)

18517 MULTIPLE SCATTERING OF SLOW NEUTRONS BY STATISTICAL MEDIA. Hara, H.; Honda, T. (Tohoku Univ., Sendai (Japan). Faculty of Engineering). Progr. Theor. Phys. (Kyoto); 52: No. 1, 68-83(Jul 1974).

A general expression for scattering cross section of slow neutrons by statistical media which includes all corrections from the multiple scattering is proposed. In place of the usual Van Hove scattering function, a general one is deduced. For a system composed of N noninteracting identical nuclei, it is represented in a form of the Van Hove scattering function $S(q,\omega)$ multiplied by a constant factor independent of q and ω, under some approximations. The numerical estimation of the constant factor is carried out. (auth)

Nuclear Properties and Reactions, A ≤ 5

18518 (BNL-20174) ANALYSIS OF π^--^{4}He SCATTERING AT 110-260 MeV. Auerbach, E. H. (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1975. 3p. (CONF-750631-2). Dep. NTIS $4.00.

From 6th international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

The π^--^{4}He data of Binon et al. were analyzed in terms of a Laplacian model for pi-nucleus scattering. The approximate constancy of the center-of-mass angle of the first minimum in this energy range is within the prediction of the model; back-angle scattering is not explicable within the model. (1 table) (auth)

18519 (CONF-750631-3) OBSERVATION OF TWO PHOTONS IN N-P CAPTURE. Dress, W. B. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1972. 7p. Dep. NTIS $4.00.

From sixth international conference on high energy physics and nuclear structure; Santa Fe, New Mexico, USA (9 Jun 1975).

The observation of two gamma rays in coincidence following the capture of subthermal neutrons by protons in water is reported. The measured branching ratio of two-gamma events to single-gamma events in the energy range of 600 keV to 1620 keV was found to be 0.0011 ± 0.0002. Possible sources of systematic error are also considered. (8 figures) (auth)

18520 (JINR-P4-8707) INTEGRAL EQUATION FOR THE WAVE FUNCTION OF THREE IDENTICAL PARTICLES IN BOUNDARY CONDITION MODEL. II. One-Dimensional Equation. Efimov, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

It is shown that the three-particle Schrödinger equation, in the case of an S-state pairing interaction, described by the boundary condition model, is exactly reduced to a one-dimensional equation. The method of obtaining the one-dimensional equation is based only on the use of the boundary conditions which the three-particle wave function obeys. (1 figure) (auth)

18521 (ORO-4043-32) EXPERIMENTS ON THE NUCLEAR INTERACTIONS OF PIONS. Progress Report, September 1, 1974–August 31, 1975. McCarthy, J. S.; Minehart, R. C.; Sobottka, S. E.; Ziock, K. O. H. (Virginia Univ., Charlottesville (USA)). 1975. Contract AT(40-1)-4043. 41p. Dep. NTIS $5.25.

Data taken at LAMPF for pi-d elastic scattering are analyzed and will yield new cross sections at energies not previously measured. Preliminary analyses at 350-MeV/c energy bracketed by existing data shows reasonable agreement. Preliminary studies of small angle pion scattering from ^{4}He have encouraged collaboration with UCLA on experiment 90 at LAMPF. Particles emitted after π^- capture in ^{12}C were identified and their energy spectra were measured at LAMPF. Experiment No. 35 at LAMPF is ready to be carried out when the accelerator is ready. A proposal to take a precision measurement of the $\pi^- - \pi^0$ mass difference was presented to LAMPF and accepted for running time. Contribution in a variety of ways to the development of the EPICS spectrometer at LAMPF is continued. Magnets were measured, an alpha particle test carried out and work on the development of the EPICS particle separator has been done. At the Space Radiation Effects Laboratory, an experiment was performed to search for solid state effects in muon capture. Results were negative. At the Bates Laboratory a contribution contributed to the development of its experimental facilities has been made. New results were obtained on the neutron and proton charge radius. A list of publications is included. (auth)

18522 (UCRL-76752) PHOTONUCLEAR STUDIES IN THE FEW NUCLEON SYSTEM. Weiss, M. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Feb 1975. 55p. (CONF-750222-1). Dep. NTIS $5.75.

From symposium on interaction studies in nuclei; Mainz, F. R. Germany (17 Feb 1975).

A brief review of photonuclear reactions in few nucleon systems is presented with comparison of theory with experiment. Discrepancies are examined and recent and current research aimed at resolving these problems are discussed. Emphasis is placed on two and three body photodisintegration. (33 figures) (SDF)

18523 A MICROSCOPIC APPROXIMATION FOR SEQUENTIAL DECAY PROCESSES IN LIGHT NUCLEAR SYSTEMS. Heiss, P. (Hamburg Univ. (F. R. Germany). 1. Inst. fuer Theoretische Physik). Z. Phys., A; 272: No. 3, 267-272(Mar 1975).

An approximative treatment for sequential decay processes is presented which uses the cluster model reaction formalism. In the case of a dominating sequential decay mechanism, the break-up amplitude is decomposed in two factors which can be obtained from two-particle reaction calculations. This factorization is essentially based on the same idea as the Watson-Migdal formalism. The method is applied to the $\alpha + d \rightarrow {}^5He + p \rightarrow \alpha + n + p$ break-up. The results are in good agreement with recent experimental data. (auth)

18524 p–d SCATTERING. Dhara, M. (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys.; 48: No. 11, 1052-1053(Nov 1974).

The phase shifts of the p-d scattering are estimated for $l = 0$, to help determine whether separable potentials have meaning in situations other than one-shell, two-particle scattering and whether the Faddeev equations are applicable to three-body problems. Estimates are made for 5 to 15-MeV energy. (GHT)

18525 DIFFERENTIAL CROSS SECTIONS AND PHASE SHIFT ANALYSIS OF ^{3}He$(p,p)^3$He BETWEEN 18.0 AND 57 MeV. Morales, J.R.; Cahill, T.A.; Shadoan, D.J. (Crocker Nuclear Laboratory and the Department of Physics, University of California, Davis, California 95616); Willmes, H. Phys. Rev. C 11: No. 6, 1905-1912 (June 1975).

Measurements of the elastic differential cross section for ^{3}He$(p,p)^3$He have been made at laboratory energies of 18.0, 20.0, 22.5, 25.0, 27.5, 30.0, 35.0 40.0, 42.7, 45.0, 48.5, and 57.0 MeV, at angles between 14.1 and 165.0° c.m. A phase shift analysis was performed in the energy range from 18.0 to 35.0 MeV using these data and polarization and spin correlation data from other sources. Angular momenta up to $l = 4$ were used in the analysis, including tensor and spin coupling terms, while inelastic channels were treated through use of complex phase shifts. The results of the analysis exhibit smooth variation with energy, extending and clarifying results obtained at lower energies. Comparisons are made to resonating group predictions of the energy dependence of the singlet and triplet phase shifts. (auth)

18526 MESON-THEORETIC POTENTIALS AND THE HYPERTRITON: A REPLY. Gibson, B.F. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544); Lehman, D.R. Phys. Rev. C 11: No. 6, 2092-2093 (June 1975).

We argue on the basis of model calculations that the introduction of short-range repulsion and Λ-Σ coupling into the separable potential approximation to meson-theoretic potentials will not alter the conclusions previously obtained. In addition, it is shown that the introduction of the tensor force into the *N-N* triplet interaction, which produces a larger effect than either of the other two modifications, will not alter the conclusions. (auth)

18527 MESON-THEORETIC POTENTIALS AND THE HYPERTRITON. Schick, L.H. (Department of Physics and Astronomy, University of Wyoming, Laramie, Wyoming 87070). Phys. Rev. C 11: No. 6, 2089-2091 (June 1975).

A previous result of Gibson and Lehman for the binding energy of $^3_\Lambda$H using a single-term nonlocal separable potential representation of a meson-theoretic ΛN potential is shown to be significantly modified when a two-term separable ΛN potential is used instead. (auth)

18528 GIANT DIPOLE RESONANCE IN NUCLEAR MUON CAPTURE. Cannata, F. (Univ., Bologna). Lett. Nuovo Cim.; 13: No. 9, 319-322(28 Jun 1975).

Muon capture by nondoubly closed-shell nuclei with $N \geq Z$ is studied. Mainly the importance of the giant dipole resonance in light nonmagic nuclei is explored. Then a discussion of dipole excitation in heavy nuclei is given. (JFP)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 18450, 18521, 18572, and 18670.

18529 (AEC-tr-7297/2) UKRAINIAN PHYSICS JOURNAL. Translation of Ukr. Fiz. Zh. (Russ. Ed.); 16: No. 2, 177-338 (Feb 1971). 218p. (TT-72-52017/02). Dep. NTIS $14.00.

A cover-to-cover translation into English of the February 1971 issue of Ukrainskii Fizicheskii Zhurnal is presented. Individual items in scope for NSA were cited from the original language edition. (RWR)

18530 (CEA-CONF-2973) DIFFERENTIAL CROSS SECTIONS FOR CARBON NEUTRON ELASTIC AND INELASTIC SCATTERING FROM 8.0 TO 14.5 MeV. Haouat, G.; Lachkar, J.; Patin, Y.; Sigaud, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). 1974. 9p. (CONF-7409106-4). Dep. NTIS (US Sales Only) $4.00.

From international symposium on neutron induced reactions; Smolenice, Czechoslovakia (1 Sep 1974).

Differential cross sections for fast neutrons scattered by carbon have been measured between 8.0 and 14.5 MeV in steps of 0.5 MeV. The angular distributions for elastic and inelastic scattering to the first excited level in ^{12}C have been obtained using the neutron time-of-flight facility of the Bruyères-le-Châtel Tandem Van de Graaff accelerator. These results are compared to previous data for neutron energies up to 9 MeV and above 14 MeV. The agreement is fairly good. No other experimental contribution seems to have been reported at this time between 9 and 14 MeV. Theoretical interpretation is in progress. (2 figures) (auth)

18531 (COO-2231-24) NEUTRON SPECTRA AT 0° FROM 71-MeV DEUTERON BOMBARDMENT OF A THICK CARBON TARGET. Madey, R.; Waterman, F. M.; Baldwin, A.; Wall, N. S. (Kent State Univ., Ohio (USA); Maryland Univ., College Park (USA)). 1974. 13p. (CONF-741088-3). Dep. NTIS $4.00.

From American Physical Society, Division of Nuclear Physics; Pittsburgh, Pennsylvania, USA (31 Oct 1974).

The principle of a two parameter spectrometer being developed for measuring omnidirectional neutron spectra was confirmed by comparing one and two parameter analyses of neutron spectra. The neutron beam was formed by the 71 MeV bombardment of a thick carbon target by deuterons. The study is of interest to biomedical programs involving high flux neutron irradiation studies. (4 figures) (SDF)

18532 (COO-2231-27) NEUTRON SPECTRA AT 0° FROM 83.7-MeV DEUTERON BOMBARDMENT OF A THICK BERYLLIUM TARGET. Madey, R.; Waterman, F. M.; Baldwin, A.; Wall, N. S. (Kent State Univ., Ohio (USA); Maryland Univ., College Park (USA)). 1975. 20p. (CONF-750427-4). Dep. NTIS $4.00.

From meeting of the American Physical Society; Washington, District of Columbia, USA (28 Apr 1974).

The measurement of neutron spectra at zero degrees from a thick beryllium target using 83.7 MeV deuterons from the University of Maryland cyclotron is reported. Experimental spectral shapes are compared with those calculated from a stripping model. (7 figures) (SDF)

18533 (COO-3244-43) EXPERIMENTAL NUCLEAR PHYSICS. Progress Report, June 1974–June 1975. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry). 1975. 30p. Dep. NTIS $4.50.

Research programs in the following areas are described: inclusive particle and gamma emission resulting from in-flight pion and proton nuclear reactions; elastic and inelastic pi^+ scattering at 25, 50, and 75 MeV; pion absorption reactions A(pi,d)B; and inelastic scattering to giant E2 resonances. Work on the computer and data acquisition systems for EPICS is briefly discussed. Short descriptions are given of work under the following headings: theoretical analysis, intrinsic Ge charged-particle spectrometer, scattering stand, data acquisition system at Carnegie-Mellon University, strong interaction effects in antiprotonic atoms, and anti pp and K^-p atomic systems. Papers describing completed work have been submitted for publication. A list of publications, reports, theses, proposals, and talks is included. (6 figures, 1 table) (RWR)

18534 (COO-3274-18, pp 90-100) RADIATION FROM HEAVY ION COLLISIONS. Kast, J. R.; Lee, Y. K. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

A study of x rays produced in heavy ion collisions has led to a search for molecular orbital x rays, concentrating on ^{35}Cl ions on Al, NaCl, and C targets. Preliminary analysis of the angular dependence of continuum x rays has tentatively identified quasi-molecular K x rays. Other work completed and in progress is discussed. (3 figures) (SDF)

18535 (ORO-3398-45, pp 8-9) NUCLEAR DENSITY MEASUREMENTS WITH ELASTIC ALPHA-PARTICLE SCATTERING. Lerner, G. M.; Hiebert, J. C.; Rutledge, L. L. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Preliminary angular distributions for elastic alpha scattering of ^{16}O, ^{40}Ca, ^{48}Ca, ^{90}Zr, and ^{208}Pb targets at an incident energy of 79 MeV are presented. The data has been tailored to the method of analysis to insure that chi^2 will be a sensitive function of the nuclear density. (3 figures) (SDF)

18536 (ORO-3398-45, pp 15-21) ALPHA CLUSTERING STUDIES. Kenefick, R. A.; Watson, J. W.; Mroz, G. J.; Donovan, R. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Several experiments involving alpha transfer and alpha knock-out were carried out with emphasis on the (d,^{6}Li) reaction. Angular distributions for ground and excited states up to about 5 MeV for target nuclei ^{16}O, ^{26}Mg, ^{27}Al, ^{28}Si, ^{39}K, ^{40}Ca are shown with DWBA fits. The (alpha,2alpha) reaction is discussed in general and several examples of data are presented. (12 figures, 1 table) (SDF)

18537 (USIP-75-04) VIBRATIONS AND POLARIZATIONS IN A CLUSTER MODEL DESCRIPTION OF STATES IN ^{12}C AND ^{16}O. Bargholtz, C. (Stockholm Univ. (Sweden). Fysiska Institutionen). Feb 1975. 22p. Dep. NTIS (US Sales Only) $4.25.

The alpha-particle model of Bloch and Brink is used to study the importance of vibrations and of polarization of the clusters in low lying states of ^{12}C and ^{16}O. The two effects are found to be approximately of the same importance for the binding energy. (auth)

18538 EXPERIMENTAL STUDY OF THE α-^{12}C ELASTIC SCATTERING. R-Matrix Analysis of the Phase Shifts and ^{16}O Levels. D'Agostino Bruno, M.; Massa, I.; Uguzzoni, A.; Vannini, G.; Verondini, E.; Vitale, A. (Univ., Bologna). Nuovo Cim.; 27A: No. 1, 1-26(1 May 1975).

Elastic scattering of alpha-particles from ^{12}C has been experimentally studied for ^{16}O excitation energies between 9.4 and 14.7 MeV. The phase shifts obtained from angular distributions have been analyzed in terms of multichannel multilevel R-matrix formalism. Ambiguities arising from this procedure are discussed. (8 figures, 6 tables) (auth)

18539 SEARCH FOR EXCITED STATES IN ^3He. Wu, Y. I. Winnipeg, Ont.; Manitoba Univ. (1972). 85p.

Thesis.

A search has been made for excited states in ^3He. The investigation consisted of two parts. In the first, a kinematically incomplete experiment, the ^3He and alpha-particle continua from the $^6Li(p, ^3He)$ and $^6Li(p, \alpha)$ reactions at an incident proton energy of 45.0 MeV were studied for structure due to excited states in ^4He and ^3He, respectively. The ^3He and alpha-particle spectra were observed from 15° to 90° (lab) in steps of 5°, using a ΔE-E detector telescope. The ^3He spectra show clearly discernible peaks due to the 20.2 and 21.4 MeV excited states in ^4He. In the alpha-particle spectra no structure has been observed that could be interpreted as due to excited states in ^3He, for excitation energies up to 17.5 MeV. A computer program was used to deduce an upper limit for possible small peaks in the alpha-particle continua. The results show no evidence of any peaks larger than 30μb/sr. The second part of the investigation was a kinematically complete experiment. The reaction $^6Li(p, \alpha d)p$ was studied at a proton bombarding energy of 45.0 MeV. The alpha-particle detector telescope was moved from −100° to −50° (lab) in steps of 10°. In addition, the coincident α-d energy spectra were measured at $\theta_\alpha = 30°$ and $\theta_d = -100°$ and −80° (lab). The measured coincidence spectra indicated a prominent p-α final-state interaction corresponding to the ground state of ^5Li. No proton-deuteron final-state interaction corresponding to $T=\frac{1}{2}$ levels in the ^3He system between 5.5 and 20 MeV has been observed. (auth)

18540 INELASTICITY OF THE NUCLEON–NUCLEUS INTERACTION AT ENERGIES 1 TO 10 TeV. Azaryan, M. O.; Keropyan, M. I.; Mamidzhanyan, E. A.; Muradyan, M. M. (Erevan Physical Inst.). Yadern. Fiz.; 21: No. 3, 567-578(Mar 1975). (In Russian).

Experimental data on inelasticity of the neutron interactions with the nuclei of carbon, air, iron, and lead are analyzed in detail for the energies 10^{12} to 10^{13} eV. Averaged quantities are determined for the total inelasticity coefficient for the neutron interaction with the nuclei. It is shown that the inelasticity coefficient K is weakly dependent on the atomic number A. The empirical function K(A) is presented. This function agrees with predictions of the Glauber multiple scattering theory. The mean free paths are determined for the absorption, $\lambda_{a,N}$, and for interaction of nucleons in the atmosphere. It is shown that without account of the "reverse current" of the particles from the set-up one gets an overestimated lower bound for $\sigma_{in\,N}$. The value of this quantity with account of the "reverse current" equals to 248 ± 20 mb. It is shown that at the nucleon energies ≥1 TeV one may neglect the nuclear splitting losses in iron. (auth)

18541 DISINTEGRATION OF NUCLEI BY 1.2-GeV ELECTRONS. Noga, V. I.; Ranyuk, Yu. N.; Sorokin, P. V. (Physical-Technical Inst., Kiev). Yadern. Fiz.; 21: No. 3, 464-467(Mar 1975). (In Russian).

The activation method was used to measure the ratio of photo- and electrodisintegration cross sections of carbon, fluorine, magnesium, aluminium and silicon nuclei for 1.2 GeV electrons. It is shown that the ratio is lower for the reactions with a proton in the final state than for those with a neutron. The found difference can be due to the quasielastic scattering contribution to the electrodisintegration cross section. (auth)

18542 ELASTIC SCATTERING OF DEUTERONS BY ^{10}B AND ^{13}C NUCLEI. Zaika, N. I.; Kibkalo, Yu. V.; Mokhnach, A. V.; Nemets, O. F.; Semenov, V. S.; Tokarev, V. P.; Shmarin, P. L. (Inst. of Nuclear Research, Kiev). Yadern. Fiz.; 21: No. 3, 460-463(Mar 1975). (In Russian).

The differential cross sections and vector analysing power of the elastic scattering of deuterons on ^{10}B and ^{13}C nuclei are measured at the energy 13.6 and 12.5 MeV, respectively. The obtained results are analyzed in the optical model. It is shown that the use of the optical potential parameters, found from the analysis of the differential cross sections for the description of the vector analysing power, leads to a qualitative agreement with experiment. The questions related to the mechanism of the process under consideration are discussed. (auth)

18543 CALCULATION OF ENERGY SPECTRA OF PIONS IN THE REACTION $^{12}C(\gamma,\pi^-p)$ ON BASIS OF THE IMPROVED MODEL OF THE PION–NUCLEUS INTERACTION. Shebeko, A. V.; Ranyuk, Yu. N. (Physical-Technical Inst., Kiev). Yadern. Fiz.; 21: No. 3, 523-530(Mar 1975). (In Russian).

Calculations of dependence of the correlation functions on the emitted pion energy are carried out for the reaction $^{12}C(\gamma,\pi^-p)$ on the bremsstrahlung γ-ray spectrum. The γ-quantum–nucleus interaction is considered in the impulse approximation, and interaction of the produced pions is taken into account in framework of the optical model, using which one gets a satisfactory explanation of the data on scattering of pions on ^{12}C in the (3,3)-resonance region. To describe the ground state of the nucleus ^{12}C the one-particle shell model is used. (auth)

18544 ELASTIC AND INELASTIC SCATTERING OF FAST NUCLEONS AND CLUSTER STRUCTURE OF ^7Li. Levshin, E. B.; Fursa, A. D. (Inst. of Nuclear Research, Kiev). Yadern. Fiz.; 21: No. 3, 531-545(Mar 1975). (In Russian).

Proton scattering by ^7Li nuclei is considered in diffraction approximation. The wave functions of the nucleon association model with the parameters explaining the mean square radii of nucleon distributions in α-particle, triton and ^7Li, are used to describe the states of the ^7Li nuclei. The formulas for differential cross sections of elastic and inelastic proton scattering with the excitation of the $\frac{7}{2}^-$, $T = \frac{1}{2}$ state (4.63 MeV) of ^7Li are obtained in analytical form, and the calculations of these cross sections are made at 185 MeV. (auth)

18545 STRUCTURE OF AMPLITUDES OF THE A(x → xN)B REACTIONS. Pak, A. S.; Roch, L.; Tarasov, A. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 3, 520-522(Mar 1975). (In Russian).

Structure of amplitudes of the A(x → xN)B reactions is studied in framework of the Watson theory with account of interactions of the particles in initial and final states. The obtained result is used to explain the equality of the cross sections for $\pi^- + {}^{12}C \rightarrow \pi^- n + {}^{11}C$ and $\pi^+ + {}^{12}C \rightarrow (\pi^+ n + \pi^0 p) + {}^{11}C$ at T = 180 MeV. (auth)

18546 ELASTIC AND INELASTIC SCATTERING OF PROTONS WITH ENERGY OF 6 MeV ON ^{12}C AND ^{13}C. Denisov, A. E.; Kolalis, R. P.; Sadkovskii, V. S.; Feofilov, G. A.; Chubinskii, O. V.; Vinogradov, L. I.; Andronov, Yu. F. (Leningrad State Univ.). Yadern. Fiz.; 21: No. 3, 472-481(Mar 1975). (In Russian).

Angular distributions of protons with primary energy of 6 MeV, scattered elastically and inelastically from the nuclei ^{12}C and ^{13}C, are measured. It is shown that an account of the production of wide ($\Gamma \geq 1$ MeV) excited levels of the intermediate nuclei ^{13}N and ^{14}N, due to the capture of the incident proton into the $d_{\frac{5}{2}}$ shell, is important in the elastic scattering. A reasonable agreement is obtained between the calculation of the elastic proton scattering on ^{12}C using the optical model with a resonance term (the OR program) and the experimental data. Comparison of the integral cross section of production of the 4.44-MeV level (2^+) in the ^{12}C nucleus with the calculation using the distorted-wave method enables one to get the parameter of the quadrupole deformation $\beta = 0.5$. The fact that the integral and differential cross sections of production of the levels 3.68-MeV ($\frac{3}{2}^-$) in the ^{13}C nucleus and 4.44-MeV (2^+) in the ^{12}C nucleus are near each other confirms the dominance of the direct mechanism of their excitation and the collective nature of the 3.68-MeV level (a member of the multiplet of levels produced by the ^{12}C nucleus in the excited 2^+ state plus a neutron in the $p_{\frac{1}{2}}$ shell). (auth)

18547 LOW ENERGY γ-RADIATION WHICH ACCOMPANIES THE SCATTERING OF 14.9-MeV NEUTRONS BY THE NUCLEI ^{16}O AND ^{12}C. Poyarkov, V. A.; Prokopets, G. A.; Strizhak, V. I. (Kiev State Univ.). Yadern. Fiz.; 21: No. 3, 468-471(Mar 1975). (In Russian).

It is shown that the quasielastic scattering of neutrons by the nuclei ^{12}C and ^{16}O is accompanied by the low energy γ radiation in 20 to 300 keV region. The radiation spectrum looks like a number of maxima of various widths. The experiments were made with 14.9-MeV neutrons scattered at 30° angle. (auth)

18548 SOME ASPECTS OF HEAVY PARTICLE STRIPPING IN LOW-LYING LEVELS OF ^{10}B. Srivastava, M. L.; Sah, J. P. (Lucknow Univ., India). Indian J. Pure Appl. Phys.; 13: No. 4, 243-245(Apr 1975).

The heavy-particle stripping and the deuteron stripping contributions were separated in neutron yield corresponding to the ground state and the 0.72-, 1.75-, 2.20-, 2.86-, and 3.69-Mev states of ^{10}B. The 2.86-MeV neutrons are predominantly produced from heavy-particle stripping, while 3.69-MeV neutrons are produced almost entirely from the deuteron stripping process. Interference effects are likely to lead to overlapping of both these states, resulting in evidence for only the higher energy level, the 2.86-MeV states escaping detection. (auth)

18549 PHOTO-PROTONS FROM HIGH-ENERGY BREMSSTRAHLUNG. Andersson, G. (Lund Univ. (Sweden). Nuclear Physics Div.); Dougan, P.; Stiefler, W. (Lund Univ. (Sweden). Synchrotron Div.). Z. Phys., A; 272: No. 3, 263-265(Mar 1975).

Recent results on the yields of high energy photo-protons from both bremsstrahlung and monochromatic photons incident mainl on carbon are compared with calculations using the Gabriel-Alsmiller model of high energy photo-induced reactions. Good agreement is found for photons of energies up to 600 MeV. (auth)

18550 β-DECAY ASYMMETRIES IN POLARIZED ^{12}B AND ^{12}N AND THE G—PARITY—NONCONSERVING WEAK INTERACTION. Sugimoto, K.; Tanihata, I.; Göring, J. (Department of Physics and Laboratory of Nuclear Studies, Faculty of Science, Osaka University, Toyonaka, Osaka 560, Japan). Phys. Rev. Lett. 34: No. 24, 1533-1537 (16 June 1975).

The decay asymmetries (A) in polarized ^{12}B and ^{12}N have been measured as a function of β-ray energy (E). The coefficients $\alpha_\pm$, in a form of $A = {}^1P(p/E)(1 + \alpha_\pm E)$, have been determined to be $\alpha_-(^{12}B) = +(0.31 \pm 0.06)$ %/MeV and $\alpha_+(^{12}N) = -(0.21 \pm 0.07)$ %/MeV. The experimental value, $\alpha_- - \alpha_+ = (0.52 \pm 0.09)$ %/MeV, is larger than the prediction of conserved-vector-current theory, $(\alpha_- - \alpha_+)_{CVC} \simeq 0.27$%/MeV, and in favor of the existence of the second-class induced-tensor current. (auth)

18551 NUCLEAR-COULOMB INTERFERENCE IN $\pi^\pm$-^{16}O SCATTERING. Mutchler, G.S.; Fletcher, C.R.; Coulson, L.V.; Mann, D.; Gabitzsch, N.D.; Phillips, G.C. (T. W. Bonner Nuclear Laboratories, Rice University, Houston, Texas 77001); Mayes, B.W.; Hungerford, E.V.; Lee, L.Y.; Goodman, C.; Allred, J.C. Phys. Rev. C 11: No. 6, 1873-1879 (June 1975).

The small angle scattering of π^+ and π^- from ^{16}O has been measured at 155, 185, and 213 Mev laboratory kinetic energy. The real part of the forward scattering amplitude was extracted from the data. The real part extrapolates to zero at 163 ± 3 MeV. (auth)

18552 MIRROR STATES IN $A = 15$ FROM 60-MeV ^{6}Li-INDUCED REACTIONS ON ^{12}C. Bingham, H.G.; Halbert, M.L.; Hensley, D.C.; Newman, E. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Kemper, K.W.; Charlton, L.A. Phys. Rev. C 11: No. 6, 1913-1924 (June 1975).

Analog pairs of states have been observed simultaneously with counter telescopes by using the $^{12}C(^6Li,t)$ and $^{12}C(^6Li,^3He)$ reactions for $E(^6Li) = 60$ MeV at excitation energies of 10.45-10.73, 12.84-13.15, and 15.05-15.49 MeV in ^{15}O-^{15}N, respectively. Magnetic spectrograph data for the $^{12}C(^6Li,t)^{15}O$ reaction having an energy resolution of 50 keV versus the 200 keV resolution of the counter systems show that single states are being strongly excited at 10.45, 12.84, and 15.05 Mev in ^{15}O. Elastic and inelastic scattering data have also been taken in the angular range from 10 to 120° c.m. with $\Delta\theta \simeq 2°$. Optical model parameters were extracted from the elastic scattering data, and quadrupole deformation lengths were obtained from a coupled-channels analysis of the inelastic scattering data to the 2^+, 4.43-MeV state in ^{12}C. Exact finite-range distorted-wave Born-approximation calculations for the transfer reactions yield a range of L transfers for each of the analog states which are consistent with the assumption that these states have spins $J_f \geq 9/2$. (auth)

18553 MASS OF ^{9}Li. Kashy, E.; Benenson, W.; Mueller, D.; Robertson, R.G.H. (Cyclotron Laboratory and Department of Physics, Michigan State University, East Lansing, Michigan 48824); Goosman, D.R. Phys. Rev. C 11: No. 6, 1959-1962 (June 1975).

New precise determinations of the ^{9}Li mass excess by observation of the $^{10}Be(d,^3He)^9Li$ reaction and by analysis of $^7Li(t,p)^9Li$ data have yielded a value of 24.9554 ± 0.0020 MeV. This value, which is 10 keV lower than previous results, makes a significant reduction in the cubic coefficient of the isobaric multiplet mass equation for the $A = 9$ ground state quartet. The new value of d, 5.8 ± 1.5 keV, is considerably closer to theoretical estimates. (auth)

18554 STUDY OF THE (^{6}Li, ^{6}He) REACTIONS. Wharton, W.R.; Debevec, P.T. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. C 11: No. 6, 1963-1975 (June 1975).

We have measured and analyzed angular distributions of (^{6}Li,^{6}He) reactions at $E_{lab} \sim 34$ MeV on targets between $A = 6$ and $A = 48$. The analysis indicates that the (^{6}Li^{6}He) reaction has sizable contributions from multistep processes except possibly for transitions of zero angular momentum transfer ($L = 0$) near closed shells. The $L = 0$ partial cross sections of the (^{6}Li,^{6}He) reaction are correlated with the known Gamow-Teller strength obtained from β-decay measurements, except for a smoothly target-dependent uncorrelated factor which makes the (^{6}Li,^{6}He) $L = 0$ cross sections too large in the middle of the s-d shell. The (^{6}Li,^{6}He) reactions should be useful in studying the distribution of Gamow-Teller strength in nuclei. (auth)

18555 TRANSIENT FIELD AT NITROGEN NUCLEI RECOILING IN IRON AND THE MAGNETIC MOMENT OF THE ^{15}N FIRST EXCITED STATE. Forterre, M.; Gerber, J.; Vivien, J.P. (Centre de Recherches Nucléaires, Strasbourg, France); Goldberg, M.B.; Speidel, K.; Tandon, P.N. Phys. Rev. C 11: No. 6, 1976-1982 (June 1975).

Precession measurements have been performed on nuclear-excited nitrogen ions recoiling in magnetized iron employing the implantation perturbed-angular-correlation technique. The transient magnetic field, calibrated with the $^{16}N(1^-)$ state, was found to be enhanced by a factor of 2.1(5) over the empirically adjusted Lindhard-Winther prediction. A negative sign was determined for this g factor and a value of $g = +0.9(3)$ for that of the $^{15}N(5/2^+)$ state. (auth)

18556 (π,d) REACTION FOR SMALL INCIDENT PION ENERGIES. Eisenstein, R.A.; Miller, G.A. (Physics Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). Phys. Rev. C 11: No. 6, 2001-2007 (June 1975).

We suggest that the reaction $\pi + A \rightarrow d + B$ provides a useful probe of nuclear structure. A model in which the pion is absorbed on a single nucleon is used to calculate the cross sections in a plane wave approximation. Results are presented for ^{18}O and ^{118}Sn targets. The high momentum transfer nature of this reaction leads to considerable sensitivity to the dineutron wave function on which the pion is absorbed. (auth)

18557 RADIATIVE DEEXCITATION OF THE 7.655-MeV STATE OF ^{12}C. Davids, C.N.; Pardo, R.C. (Center for Nuclear Studies, University of Texas at Austin, Texas 78712; Obst, A.W. Phys. Rev. National Laboratory, Argonne, Illinois 60439); Obst, A.W. Phys. Rev. C 11: No. 6, 2063-2068 (June 1975).

A new measurement is reported of the radiative branching ratio for the 7.655-MeV state of ^{12}C. This quantity is needed for calculations of stellar helium burning. Coincidences between ^{12}C recoils of the proper energy and protons inelastically scattered from ^{12}C signified the radiative decay of the 7.655-Me* state. A value of $(4.30 \pm 0.20) \times 10^{-4}$ was obtained for the branching ratio, compared with a recent measurement of $(4.20 \pm 0.22) \times 10^{-4}$ and the previous best value of $(2.9 \pm 0.3) \times 10^{-4}$. (auth)

18558 IS THERE EVIDENCE OF THREE-BODY FORCES FROM VIOLATION OF THE KOLTUN ENERGY SUM RULE?

Faessler, A. (Institut für Kernphysik der Kernforschungsanlage Jülich, D-517 Jülich, West Germany and University of Bonn, D-53 Bonn, West Germany); Krewald, S.; Wagner, G.J. Phys. Rev. C 11: No. 6, 2069-2072 (June 1975).

The suggested failure of the model independent energy sum rule of Koltun in a recent $(e,e'p)$ experiment is studied in light of current Hartree-Fock theory. It is shown that the use of (i) density dependent forces or (ii) partial occupation probabilities compensates for the restricted momentum and energy range of the experimental proton spectral function, and can explain the sum rule violation. (auth)

18559 $E0$ DECAY OF THE TWO FIRST EXCITED 0^+ STATES IN ^{18}O. Souw, K.H.; Adloff, J.C.; Disdier, D.; Chevallier, P. (Centre de Recherches Nucléaires, Universite Louis Pasteur, Strasbourg, France). Phys. Rev. C 11: No. 6, 1899-1904 (June 1975).

The reaction $^{19}F(t,\alpha)^{18}O$ has been to study the $E0$ π decays of the $^{18}O(3.63\ MeV,0^+)$ and $^{18}O(5.33\ MeV,0^+)$ states to the ground state. The $E0$ branching ratios Γ_π/Γ were measured to be, respectively, $(3.0 \pm 0.6) \times 10^{-3}$ and $\leq 2.3 \times 10^{-3}$. When these values are combined with the available lifetimes of these states, $E0$ matrix elements $\langle M \rangle_\pi = (6.0 \pm 0.7) fm^2$ [$^{18}O(3.63\ meV)$] and $\leq 4.5\ fm^2$ [$^{18}O(5.33\ MeV)$] are obtained. The properties of these states are compared to the theoretical predictions. (auth)

18560 COMPARISON OF ACTIVATION AND DIRECT MEASUREMENT YIELDS FOR THE $^{13}C(p,n)^{13}N(g.s.)$ REACTION. Lind, D.A.; Peterson, R.J.; Fielding, H.W. (Nuclear Physics Laboratory, Department of Physics and Astrophysics, University of Colorado, Boulder, Colorado 80302). Phys. Rev. C 11: No. 6, 2099-2102 (June 1975).

A measurement was made of the angular distribution of neutrons from the $^{13}C(p,n)^{13}N(g.s.)$ from which the total cross section leading to the ground state of ^{13}N was determined. At the same time, the determination of the ^{13}N activity was made. The ratio of the reaction cross sections at 22.8 MeV determined from ^{13}N activation to the yield of the ground state neutron group is 1.06 ± 0.07. Thus there is no significant competition in the decay of excited states by γ emission with particle emission. This result implies that the reaction can be used as a convenient fast neutron calibration source. (auth)

18561 $^{16}O(\alpha,^3He)^{14}O$ REACTION. Jänecke, J.; Becchetti, F.D.; Chua, L.T.; VanderMolen, A.M. (Cyclotron Laboratory, Department of Physics, The University of Michigan, Ann Arbor, Michigan 48105). Phys. Rev. C 11: No. 6, 2114-2116 (June 1975).

The $^{16}O(\alpha,^3He)^{14}O_{g.s.}$ reaction has been observed at $E_\alpha = 58$ MeV. The measured cross section is 40 ± 15 nb/sr at $\theta_{lab} = 8°$. The mass excess of ^3He was determined to be $31\,600 \pm 25$ keV. Possible reaction mechanisms are discussed. (auth)

Nuclear Properties and Reactions, $20 \leq A \leq 38$

Refer also to abstracts 18528, 18541, 18554, and 18558.

18562 (COO-3274-18, pp 28-48) NUCLEAR MAGNETIC MOMENT MEASUREMENTS AT LASL. Correll, F. D.; Haskell, R. C.; Madansky, L. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

A target chamber is described that provides for the cooling of stopping foils to liquid helium temperatures. With this equipment, the production of polarized ^{25}Al nuclei in the $^{24}Mg(d,n)^{25}Al$ reaction has been investigated, and the relaxation time of polarized ^{25}Al in cryogenically cooled metal foils has been estimated to be on the order of 1–2 seconds. (5 figures) (SDF)

18563 (ITP-74-73P) ELECTROEXCITATION OF LIGHT DEFORMED NUCLEI. Tartakovskii, V. K.; Gomshi, A. K.; Levshin, E. B. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 31p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

The cross-sections of electroexcitation of the low-lying collective states of light deformed nuclei are calculated using the Davydov–Filippov and the Davydov–Chaban models. It is shown that the behavior of inelastic form-factors of nuclei is sensitive to their dimensions, the choice of the charge density dependence, non-axiality and nuclear deformability. The results of calculations are compared with the available experimental data and the possibility of obtaining the new information on nuclei is discussed. (9 figures, 1 table) (auth)

18564 SHELL-MODEL CALCULATIONS IN THE SD SHELL. V. The Structure of Mass-23 Nuclei. Cole, B. J.; Watt, A.; Whitehead, R. R. (Univ. of Glasgow). J. Phys., G. (London); 1: No. 3, 303-323(1 Apr 1975).

Untruncated shell-model calculations have been performed for even-parity low-lying levels in ^{23}Na, ^{23}Mg and ^{23}Ne, using the two-body interactions of Kuo and Preedom and Wildenthal. Excitation energies, transition rates and static moments have been calculated. When allowance is made for shifted bands in all spectra good agreement is achieved with both interactions for a wide range of data. The structure of the three nuclei is discussed in the light of these calculations. (auth)

18565 FURTHER EVIDENCE OF ROTATIONAL STRUCTURE IN ^{26}Mg. Nagel, A.; Jones, G. D.; Lornie, P. R. G.; Nixon, M. R.; Price, H. G.; Twin, P. J. (Univ. of Liverpool). J. Phys., G. (London); 1: No. 3, 324-333(1 Apr 1975).

The 4.350 MeV (3^+) and 5.716 MeV (4^+) states in ^{26}Mg have been studied with particle γ ray angular correlation measurements using the reaction $^{25}Mg(\alpha,\alpha'\gamma)^{26}Mg$ with Ge(Li) detectors. Branching ratios and E2/M1 mixing ratios were deduced; in particular a new 815 keV transition (5.716 → 4.901 MeV) has been found. The E2 transition strengths of the cascading γ rays with 1366 keV ($4^+ \rightarrow 3^+$) and 1412 keV ($3^+ \rightarrow 2^+$) of 3 ± 1 and 9^{+4}_{-3} Weisskopf units respectively support the assignment of the 4.350 and 5.176 MeV states to the $K^\pi = 2^+$ rotational band based on the 2.938 MeV (2^+) state. The results are compared with recent deformed shell model calculations. Nineteen further states between 6 and 9.1 MeV were excited; a decay scheme has been established and several branching ratios are reported. The possible assignment of high spins to some of the higher states is discussed. (auth)

18566 STUDIES ON THE NUCLEI ^{33}S, ^{33}Cl, AND ^{35}S. van der Mark, Th. W. Groningen, Netherlands; Rijksuniversiteit (1975). 94p.

Thesis.

In order to study lower negative-parity states of ^{33}S, ^{33}Cl and ^{35}S, level schemes were investigated by gamma spectroscopy for the reaction $^{32}S(d,p\gamma)^{33}S$ at 4.72 and 4.25 MeV, $^{34}S(d,p\gamma)^{35}S$ at 4.72 MeV deuteron energy and $^{32}S(p,\gamma)^{33}Cl$ at 1.892 MeV proton resonance for which Γ_γ was determined. Information about the 8.209 MeV ground state gamma transition following the reaction $^{34}S(p,\gamma)^{35}Cl$ at the 1.891 MeV proton resonance was obtained at the same time. The multipole mixing ratio, δ, was derived from the measured angular distribution of the gamma rays. Using the branching ratio as seen from the gamma spectra measured by Ge(Li) detectors, spins and parities were deduced. By analysing the alpha spectrum from the $^{37}Cl(d,\alpha\gamma)^{35}S$ reaction at 4.25 MeV some levels of ^{35}S were established. Shell model calculations using the isospin formalism and a Modified Surface Delta Interaction were done for ^{33}S, ^{33}Cl, ^{35}S and ^{35}Cl. Levels and multipole transition rates are calculated and compared with experiment. Better agreement was obtained than in earlier calculations. Formulae and some values for multipole reduced matrix elements are given. (auth)

18567 ENERGY DEPENDENCE OF PROTON DAMAGE IN SILICON. Akkerman, A. F.; Botvin, V. A.; Chubisov, M. A. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 50-55(1974). (In Russian).

Study of the energy dependence of proton damage in silicon indicated the necessity of considering the non-Rutherford nature of elastic scattering of protons with an energy greater than 8 to 10 MeV. An empirical formula was found for the cross-section of elastic scattering as a function of the proton energy in the interval 17–61 MeV. Calculation of the number of defects using the experimental cross sections of elastic scattering of protons on the ^{28}Si nucleus agreed with experimental data in the assumed predominance of the role of the disorder field in the process of defect formation. Comparison of experimental and calculated rates of introduction of a complex of four Si-rare earth vacancies showed that the energy threshold for its formation is 5 to 10 MeV. (3 figures, 2 tables) (tr-auth)

18568 STUDY OF THE REACTIONS $^{50}Cr(p,p)^{50}Cr$, $^{34}S(d,d)^{34}S$, AND $^{34}S(d,p)^{35}S$ WITH POLARIZED PROTONS AND DEUTERONS. Badovskii, V. P.; Vorob'ev, A. V.; Egoshin, V. G.; Lylo, V. V.; Palkin, G. P.; Prokopenko, V. S.; Saltykov, L. S.; Stryuk, V. S.; Chirko, V. I. (Inst. of Nuclear Research, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 3, 503-505(Mar 1975). (In Russian).

The angular dependence of the polarization during elastic scattering of polarized protons at 14.8 MeV and of the left-right asymmetry of protons at 10.8 Mev on ^{50}Cr was measured by the double scattering method. The vector analyzing capacity in the $^{34}S(d,d)$ ^{34}S reaction and the angular dependence of the left-right asymmetry of protons in the $^{34}S(d,p)$ ^{35}S stripping reaction for mixtures of the first excited states of ^{35}S at angles from 18 to 63° in the center of mass system were measured. The value of the polarization of the protons in the stripping reaction $^{12}C(d,p)$ ^{13}C was determined at an angle of 25° in the laboratory system with formation of ^{13}C in the ground state with deuteron energy at 13.8 MeV. The polarized deuterons and protons were obtained by elastic scattering of the primary 13.8-MeV deuteron beam on

carbon and in the reaction $^{12}C(d,p)\ ^{13}C$ at a scattering angle of 25° in the laboratory system. (tr-auth)

18569 LIFETIME OF THE 563-keV LEVEL OF ^{24}Na. du Marchie van Voorthuysen, E.H.; Keverling Buisman, A.S.; Becker, A.; Smith, Ph.B. (Laboratorium voor Algemene Natuurkunde, Rijksuniversiteit Groningen, Groningen, The Netherlands). Phys. Rev. C 11: No. 6, 1943-1947 (June 1975).

The lifetime of the 563-KeV level of ^{24}Na has been measured by means of the recoil-distance method. In the geometry used, the "stopped" and "shifted" peaks lie above and below the K edge of bismuth. The use of a bismuth absorber of suitable thickness essentially eliminated the stopped peak from the spectrum, leading to an exponential function for the transmitted intensity as a function of the recoil distance. The mean life was measured as $\tau_m = 62 \pm 8$ ps. (auth)

18570 HIGH-SPIN STATES OF ^{28}Al. Freeman, R.M.; Haas, F.; Achari, A.R.; Modjtahed-Zadeh, R. (Laboratorie de Physique Nucléaire et d'Instrumentation Nucléaire, Centre de Recherches Nucléaires et Université Louis Pasteur, Strasbourg, France). Phys. Rev. C 11: No. 6, 1948-1952 (June 1975).

Stripping angular distributions for the $^{27}Al(d,p)^{28}Al$ reaction, lifetime and branching ratio measurements demonstrate the similarity between the configurations of the 4033 and 5165 keV levels of ^{28}Al. The 5165 keV level is probably the $J^\pi = 6^-$ state predominantly of configuration $d_{5/2}^{-1}f_{7/2}$. Lifetime and branching ratio measurements are also reported for the 2581 keV level for which $J^\pi = 5^+$ had been proposed. (auth)

18571 LEVELS OF ^{38}K: THE $^{40}Ca(d,\alpha)$, $^{40}Ca(d,\alpha\gamma)$, AND $^{36}Ar(^3He,p\gamma)$ REACTIONS. Collins, W.K.; Longo, D.S.; Mateja, J.F.; Chagnon, P.R.; Berners, E.D.; Neal, G.F.; Browne, C.P.; Jolivette, P.L.; Rollefson, A.A.; Gross, J.D. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. C 11: No. 6, 1925-1936 (June 1975).

Precise level energies in ^{38}K have been measured up to the region of 6 MeV in excitation with our 100-cm broad-range magnetic spectrograph and the $^{40}Ca(d,\alpha)$ reaction. With a Ge(Li) detector, γ-ray energies were measured in the $^{40}Ca(d,\alpha\gamma)$ and $^{36}Ar(^3He,p\gamma)$ reactions. Some 79 states have been identified in this region of excitation, approximately 30 of which have not previously been reported. Uncertainties in excitation energies are 1 to 3.5 keV. Branching ratios for levels up to 5.2 MeV were determined, and particle-γ angular correlations were measured with the $^{36}Ar(^3He,p\gamma)$ reaction. The mean lives of some levels in ^{38}K excited in the $^{40}Ca(d,\alpha\gamma)$ reaction at $E_d = 7.84$ MeV have been determined using the Doppler-shift attenuation method. The following mean lifetimes were deduced (excitation energy in keV, lifetime fs): 3431, < 170; 3615, 700_{-310}^{+850}; 3688, 95 ± 55; 3688, 400_{-120}^{+160}; 3702, > 1100; and 4333, 350_{-250}^{+700}. The angular correlations, with the lifetimes were deduced (excitation energy in keV, lifetime in fs): the 3431-, 3615-, and 3688-keV levels, respectively: $J^\pi = (2)$, (3⁻ or 5⁻), (3), where parentheses indicate assignments dependent upon unproven assignments to other levels from the literature. The observed decays further imply $J = (1,2)$ for both the 3857- and 4214-keV levels. Clarifications of several ambiguous and erroneous level identifications in the literature are offered. (auth)

18572 STATES AT HIGH EXCITATION IN ^{20}Ne. Medsker, L.R.; Fortune, H.T.; Betts, R.R.; Middleton, R. (Physics Department, University of Pennslyvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 11: No. 6, 1880-1893 (June 1975).

The $^{12}C(^{12}C,\alpha)^{20}Ne$ reaction has been studied at bombarding energies of 36.0, 36.5, and 37.0 MeV. States up to 16 MeV excitation in ^{20}Ne were identified. Several previously unreported levels were observed, a number of which are excellent candidates for missing unnatural-parity states. We summarize existing spin-parity information for several "elusive" states. (auth)

18573 d-γ ANGULAR CORRELATIONS AS A TEST FOR THE IMPORTANCE OF MULTISTEP PROCESSES IN THE REACTION $^{24}Mg(d,d')$. Scheib, U.; Hofmann, A.; Vogler, F. (University Erlangen-Nürnberg, Erlangen, Germany). Phys. Rev. Lett. 34: No. 25, 1586-1588 (23 June 1975).

The in-plane $^{24}Mg(d,d_1\gamma)$ angular correlation has been measured at an incident energy of 10 MeV. Analyses of the experimental data with distorted-wave and coupled-channel Born-approximation calculations show that multistep processes are important to describe this reaction although the distorted-wave Born approximation reproduces quite well the differential cross section. (auth)

18574 STRONG POLARIZATION OF THE 1p-SHELL CORE IN THE LOWEST 0⁺ STATES OF ^{24}Mg AND ^{28}Si. Morsch, H.P.; Dehnhard, D.; Li, T.K. (Williams Laboratory of Nuclear Physics, University of Minnesota, Minneapolis, Minnesota 55455). Phys. Rev. Lett. 34: No. 24, 1527-1530 (16 June 1975).

Inelastic α scattering to the first excited 0⁺ states in ^{24}Mg and ^{28}Si has been measured at E_α=23.5 MeV and analyzed in a microscopic model. Strong evidence for the need of including $1p_{1/2}$ hole components in the wave functions of the lowest 0⁺ states was found. Deduced $E0$ matrix elements are in surprisingly good agreement with results from electron scattering. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 18528, 18529, 18535, 18540, 18554, 18558, 18568, 18571, 18614, and 18661.

18575 (COO-2146-6) PROGRAM IN MEDIUM ENERGY NUCLEAR PHYSICS RESEARCH. Technical Progress Report. Willard, H. B. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Physics). 23 May 1975. Contract AT(11-1)-2146. 20p. Dep. NTIS $4.00.

MWPC chambers, readout electronics, and a PDP-11/45 computer have been assembled at LAMPF, tested as a system, and used to obtain experimental results on two experiments: (1) Absolute differential cross sections for proton–proton elastic scattering at 647 and 800 MeV were measured to about 3 percent accuracy for center-of-mass angles from approximately 20° to 90°. (2) Preliminary measurements were made of the differential cross sections for protons scattered by ^{40}Ca to determine the total and total reaction cross sections. Radiative pion capture in tritium has been studied in a collaborative experiment with the Berkeley group. (2 figures) (auth)

18576 (COO-3274-18, pp 1-7) GAMMA-RAY LINEAR POLARIZATION MEASUREMENTS FOLLOWING HEAVY-ION BOMBARDMENT OF 2s–1d SHELL NUCLEI. Kim, J. S.; Lee, Y. K.; Warburton, E. K. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

Information contained in polarization measurements of ^{39}K, ^{41}K, and ^{41}Ca is discussed. In particular, suggested spin sequences, multipolarities, and multipole mixing ratios are given along with theoretical and experimental linear polarizations for transitions in ^{41}Ca. Identification of these transitions has been based largely upon gamma-gamma coincidence data from the $^{18}O + ^{26}Mg$ reaction. In all but two cases, the results confirm or strongly support spin/parity assignments previously set forth. (1 table, 1 figure) (SDF)

18577 (ORNL-TM-4921) TOTAL CROSS-SECTION EXPERIMENTAL CHECK. Milestone 3.a. 189a No. 10028, Activity No. HN 04 01 01 1. Clifford, C. E.; Muckenthaler, F. J.; Stevens, P. N. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 66p. AT.

A series of experiments performed at the Tower Shielding Facility to check the accuracy of the total cross sections for iron, nickel, chromium, and the elements in stainless steel is described. Reunfolded results of NE-213 spectral measurements made in November, 1973 are presented along with the results of the May 1974 NE-213 and Bonner ball measurements. The May 1974 measurements were made because of background difficulties associated with the November 1973 results. It was found that the May 1974 experimental configuration essentially eliminated the background problems experienced with earlier configurations. (17 figures, 18 tables) (auth)

18578 (WAPD-T-2566) GAMMA-RAY PRODUCTION CROSS SECTIONS FOR NEUTRON INELASTIC SCATTERING FROM Cr, Ni, ^{92}Zr, AND ^{94}Zr FROM 3 TO 6 MeV. Tessler, G.; Glickstein, S. S. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). 1972. Contract AT(36-1)-GEN-14. 32p. (CONF-740201-7). Dep. NTIS $4.75.

From topical conference on energy; Chicago, Illinois, USA (4 Feb 1974).

Cross sections for gamma-ray production by neutron inelastic scattering from $^{50+52+53+54}$Cr, $^{58+60+62}$Ni, ^{92}Zr, and ^{94}Zr, have been measured for incident neutrons in the energy range 3–6 MeV. The gamma-rays were detected with a 55 cm^3 coaxial Ge(Li) anti-Compton spectrometer located at 55 degrees to the incident neutron direction. Background associated with neutrons scattering off the samples into the Ge(Li) detector was suppressed by the pulsed beam time-of-flight technique. Assignment of gamma-rays to transitions from specific energy levels has been made using the gamma-ray energies determined from this work and previously measured energies and level schemes reported in the literature. Many of the observed gamma-rays could not be assigned to known levels. (11 figures, 8 tables) (auth)

18579 DEFORMATION OF ^{56}Fe FROM 104 MeV α-PARTICLE SCATTERING. Gils, H. J. (Kernforschungszentrum, Karlsruhe, Ger.); Rebel, H.; Nowicki, G.; Ciocanel, A.; Hartmann, D.; Klewe-Nebenius, H.; Wissaak, K. J. Phys., G (London); 1: No. 3, 344-357(1 Apr 1975).

Measured differential cross sections for elastic and inelastic scattering of 104 MeV α-particles from ^{56}Fe are analysed in terms of coupled channels on the basis of symmetric and asymmetric rotator models. The analyses use a semi-microscopic

folding procedure and in some cases the conventional extended optical model is also used. Deformation parameters, RMS radii, multipole moments of the nuclear matter distribution, and transition probabilities have been extracted. (auth)

18580 INELASTIC ELECTRON SCATTERING FROM ^{52}Cr AND ^{54}Fe. de Bie, J. E. P. Amsterdam; Amsterdam Univ. (1975). 98p.

The nuclei of ^{52}Cr and ^{54}Fe were subjected to inelastic electron scattering experiments with electrons of energy between 30 and 88 MeV. Analysis of the form-factor results of the L = 2, L = 3 and L = 4 transitions in these even–even nuclei in terms of the Tassie and Gauss models was performed in DWBA, and yielded accurate values for reduced transition probabilities and for transition radii. The L = 0, L = 2, L = 3 and L = 4 form-factor data of transitions in ^{52}Cr have also been studied in terms of the harmonic vibrator model. Assuming that the first excited 2^+ state is a pure one-phonon quadrupole state, the experimental form factors for the weak 2^+(2.96 MeV) and 0^+(2.65 MeV) transitions agree with the model predicted for two-phonon transitions. The 4^+ two-phonon transition could not be reproduced. The 2_1^+ state at 1.43 MeV and the 2_2^+ state at 3.16 MeV also were analyzed with the anharmonic-vibrator model; no agreement between theory and experiment could be obtained. On the other hand, the form factor of the 3.77 MeV (2^+) transition could be reproduced under certain assumptions. The form factor results of L = 2 and L = 4 transitions in ^{52}Cr and ^{54}Fe were analyzed in terms of the nuclear shell model. A fit with the 1f → 1f transition charge density to the L = 2 form-factor data resulted in reasonable values for the harmonic-oscillator size parameter, whereas the values derived from the fits with the 1f → 2p form factor were too small, except in case of the 3.77 MeV level in ^{52}Cr, which showed the expected form. (NL)

18581 INTERACTION OF HELIUM IONS WITH ^{56}Fe NEAR 33 MeV. Weisrose, S. A.; Griffiths, R. J.; Clarke, N. M. (King's Coll., London). J. Phys., G (London); 1: No. 3, 334-343(1 Apr 1975).

The ^{56}Fe(^{3}He, ^{4}He) reaction has been measured at 83 MeV together with the elastic scattering for ^{3}He at 83 MeV and ^{4}He at 86 MeV. The ^{3}He scattering produced a unique optical potential when analysed with a six parameter model but contrasts with the analysis of the ^{4}He scattering for which two acceptable optical potentials were found. The energy dependence of the ^{3}He optical model potential cannot be accommodated over a wide range by a fixed geometry analysis. The limitations of DWBA under angular momentum mismatch conditions for the (^{3}He, ^{4}He) reaction are discussed. (auth)

18582 SURVEY OF 600-MeV PROTON CROSS-SECTIONS FOR SPALLOGENIC RADIONUCLIDES IN QUARTZ-, Fe-, Co-, AND Ni-TARGETS. Weigel, H.; Michel, R.; Herpers, U.; Herr, W. (Cologne Univ.). Radiochem. Radioanal. Lett.; 21: No. 5, 293-300 (24 May 1975).

There were 30 production cross sections determined for the radionuclides ^{57}Ni, ^{62}Co, ^{58}Co, ^{57}Co, ^{56}Co, ^{54}Mn, ^{52}Mn, ^{51}Cr, ^{48}V, ^{47}Sc, ^{46}Sc, ^{44m}Sc, ^{22}Na, and ^{7}Be produced by 600-MeV protons in the targets quartz, Fe, Co, and Ni. The resulting cross sections are compared with literature values (as far as available till the end of 1973). New data are presented for the reactions on the cobalt target. On Ni the formerly unknown cross sections of ^{60}Co, ^{58}Co, ^{57}Co, and ^{48}V were established, as well as those of ^{22}Na and ^{7}Be from a quartz target. (auth)

18583 EXPERIMENTAL ANALYSIS ON THE ASYMMETRY AT SMALL ANGLES IN THE ELASTIC SCATTERING OF 40-MeV POLARIZED PROTONS ON ^{40}Ar NUCLEI. Bendiscioli, G.; Gigli Berzolari, A.; Lodi Rizzini, E. (Univ., Pavia, Italy). Nuovo Cim.; 27A: No. 1, 27-36(1 May 1975).

By means of a diffusion cloud chamber an experiment has been carried out on the elastic scattering of 40 MeV polarized protons on argon nuclei. The asymmetry behavior between 1° and 10° is given. (1 table, 5 figures) (auth)

18584 NUCLEAR ENERGY LEVELS: APPLICATIONS TO COMPLEX ^{57}Fe MOESSBAUER SPECTRA. Arif, S. K.; Bunbury, D. St. P.; Bowden, G. J.; Day, R. K. (Univ. of Manchester, Eng.). J. Phys., F (London).; 5: No. 5, 1037-1047(May 1975).

Explicit expressions are derived for the energy levels of a nucleus in the presence of a strong magnetic field and a small quadrupole interaction. The case of a spin 3/2 nucleus is considered in some detail and certain inequalities between the various Zeeman energy level spacings are derived. These inequalities are used to show that computer programs which adjust the energy level separations in a least squares fit to ^{57}Fe Moessbauer spectra can lead to unphysical results. Special reference is made to the (rare earth) Fe_3 intermetallic compounds. (auth)

18585 PHOTOPROTON SPECTRA FROM ^{58}Ni. Varlamov, V. V.; Ishkhanov, B. S.; Kapitonov, I. M.; Kocharova, Zh. L.; Pevtsova, I. K.; Piskarev, I. M.; Shevchenko, O. P. (Moscow State Univ.). Yadern. Fiz.; 21: No. 3, 457-459(Mar 1975). (In Russian).

The photoproton spectra for five different values of the upper limit of the bremsstrahlung energy are measured in order to study the decay characteristics of the giant dipole resonance in the ^{58}Ni nucleus. (auth)

18586 PECULIARITIES OF QUASIELASTIC PN SCATTERING ON ODD NUCLEI. Guba, V. G.; Urin, M. G. (Moscow Engineering-Physical Inst.). Yadern. Fiz.; 21: No. 3, 546-550(Mar 1975). (In Russian).

Based on the shell model, peculiarites of the quasielastic pn scattering on odd nuclei with relatively small neutron abundance are considered. It is shown that the contribution from the odd neutron to the total cross section is due, mainly, to the spin part of the effective nucleon interaction and enhanced by some kinematical factors. (auth)

18587 APPLICATION OF THE STRUTINSKY METHOD TO INVESTIGATE THE NUCLEAR SHELL EFFECTS IN THE DENSITY OF EXCITED STATES. Adeev, G. D.; Cherdantsev, P. A. (Tomsk Polytechnical Inst., USSR). Yadern. Fiz.; 21: No. 3, 491-501 (Mar 1975). (In Russian).

Density of highly excited states of nuclei in the interval $48 \leq A \leq 252$ is calculated in the superfluid model using the one-particle spectrum of the Nilsson model. It is shown that in the excitation energy interval 40 to 80 MeV the parameters of the Fermi-gas model, describing the calculated density, may be calculated approximately by means of the shell-correction method. The shell effects on the state density and their vanishing with an increase of the excitation energy are studied by means of comparison with calculations carried out assuming the spectrum smoothed using the Strutinsky method. (auth)

18588 ISOTOPIC EFFECT IN CHARGED PION PRODUCTION IN PROTON COLLISIONS WITH NUCLEI. Balin, D. V.; Batusov, Yu. A.; Bogatin, V. I.; Bondarev, V. K.; Litvin, V. F.; Lozhkin, O. V.; Oganesyan, K. O.; Porokhovoi, S. Yu.; Yakovlev, Yu. P. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 3, 482-484(Mar 1975). (In Russian).

A strong isotopic effect in the π^--yields and the ratios of π^+- to π^--meson yields at an angle of 90° for the boundary isotopes of nickel and tin by bombarding the isotopes with 660-MeV protons was found. (auth)

18589 ISOTOPE EFFECTS IN ELASTIC NEUTRON SCATTERING. Pasechnik, M. V.; Fedorov, M. B.; Yakovenko, T. I. (Inst. of Nuclear Research, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 3, 388-391(Mar 1975). (In Russian).

The data on 2.9 MeV neutron scattering by the isotopes Cr^{50}, Cr^{54}, Fe^{54}, Ni^{58}, Ni^{60}, Ni^{62}, Zn^{64}, Zn^{66} and Mg are analyzed on the basis of the optical model. The data of other authors are also used. Main attention is paid to finding isotope effects which can be detected in elastic neutron scattering. (2 figures) (auth)

18590 DIRECT PROCESSES IN 2.9 MeV NEUTRON SCATTERING BY ^{50}Cr, ^{54}Cr, ^{54}Fe, ^{64}Zn, AND ^{66}Zn NUCLEI. Fedorov, M. B.; Yakovenko, T. I.; Surovitskaya, N. T.; Korbetskii, E. V.; Sokolov, L. S. (Inst. of Nuclear Research, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 3, 384-387(Mar 1975). (In Russian).

Experimental angle distributions of 2.9 MeV neutrons scattered by the separated isotopes Cr^{50}, Cr^{54}, Fe^{54}, Zn^{64}, Zn^{66} are analyzed on the basis of the generalized optic model. The calculation results are in agreement with the idea that the process of inelastic scattering of moderate-energy neutrons is accompanied mainly by formation of the compound nucleus. But in case of strong bond of the channels direct inelastic scattering may be of essential importance in terms of the described model. The value of the integral cross-section of potential scattering reaches 20% of the excitation cross-section of the first levels of the nuclei under analysis. (2 tables, 1 figure) (auth)

18591 STUDY OF THE ^{40}Ar(^{3}He,d)^{41}K REACTION. Medsker, L.R.; Fortune, H.T.; Headley, S.C.; Bishop, J.N. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 11: No. 6, 1937-1942 (June 1975).

The ^{40}Ar(^{3}He,d)^{41}K reaction has been studied at a bombarding energy of 18 MeV. The ^{40}Ar target was contained in a gas cell with no entrance window. Excitation energies and angular distributions were obtained for 80 levels below $E_x = 7.8$ MeV in ^{41}K. A distorted-wave analysis was used to determine l values and spectroscopic strengths. The proton configurations of ^{41}K are examined in comparison with previous data on reactions and radioactive decay. (auth)

18592 ^{41}K(^{3}He,t) REACTION AT 25 MeV. Greenwood, M.S.; Pluta, M. (De Paul University, Chicago, Illinois 60614 Greenwood, L.R.; Anantaraman, N. Phys. Rev. C 11: No. 6, 1983-1994 (June 1975).

Angular distributions for the $^{41}K(^3He,t)^{41}Ca$ reaction were measured for 35 states up to 7.61-MeV excitation energy in ^{41}Ca. L values were deduced from a microscopic distorted-wave Born-approximation analysis. Of especial interest was the comparison of $T_<$ and $T>$ states with the same shell-model configurations. The $7/2^-$ ground state and $7/2^-$ excited analog state at 7.12 MeV were both fitted by $L = 3 + 5$, although the data exhibited more structure and peaked at a more forward angle than the DW calculation. Whereas the angular distribution of the $3/2^+$ analog state at 5.822 MeV was described principally by $L = 0$, the angular distribution of the $3/2^+$ antianalog state at 2.005 MeV was fitted by $L = 2$. Evidence is presented to show that the $L = 2$ character of the angular distribution of the antianalog state is due to the $f_{7/2} \rightarrow f_{7/2}$ transition with $L = 2$, $S = 0$. The 2.68- and 3.394-MeV states with $J^\pi = 1/2^+$, excited by $l_n = 0$ in $^{42}Ca(p,d)$, can be obtained by either $f_{7/2} \rightarrow f_{7/2}$ or $s_{1/2} \rightarrow d_{3/2}$ transitions, both with $L = 2$, $S = 0$. However, the 2.68-MeV state was not observed, suggesting that the effect of the two competing transitions enhance 3.394-MeV state but may tend to cancel for the 2.68-MeV state. The 4.098-MeV state ($J^\pi = 5/2^+$ was strongly excited and appears to arise from the $f_{7/2} \rightarrow f_{7/2}$ transition with $L = 2$ and $S = 0$ or 1. The transition to the 2.875-MeV level, known to have $l_n = 4$ in $^{40}Ca(d,p)$, was assigned $L = 2$, thus strongly suggesting $J^\pi = 7/2^+$ since spin-flip excitation is expected to be weak. (auth)

18593 SPECTROSCOPY OF ^{52}Mn FROM THE $^{54}Fe(p,^3He)$ REACTION AT 40.2 MeV. Guichard, A.; Benenson, W.; Nann, H. (Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 11: No. 6, 2027-2033 (June 1975).

The $^{54}Fe(p,^3He)$ reaction has been studied at 40.2 MeV between 6° and 60°. Assignments of L transfers have been made with distorted-wave Born approximation calculations. These results are compared with other two-nucleon transfer data and theoretical shell-model calculations. (auth)

18594 DISTORTED-WAVE BORN-APPROXIMATION INTERACTION POTENTIALS FOR MULTINUCLEON HEAVY-ION TRANSFER REACTIONS. DeVries, R.M. (Nuclear Structure Research Laboratory, University of Rochester, Rochester, New York 14627). Phys. Rev. C 11: No. 6, 2105-2107 (June 1975).

The six interaction potentials defined in a distorted-wave Born-approximation calculation are considered for multinucleon transfer heavy-ion reactions. In order to get the necessary post-prior equivalence, all terms must be included; however, at this time the most reasonable solution is to include the normally neglected Coulomb potentials in post-representation calculations. (auth)

18595 ^{44}Ca YRAST LEVELS. Kim, H.J.; Robinson, R.L.; Milner, W.T. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. C 11: No. 6, 2108-2110 (June 1975).

The yrast levels of ^{44}Ca investigated via the in-beam study of γ rays from the 30-40- MeV ^{16}O bombardment of enriched ^{30}Si targets. Present results show that the 5.086 MeV $\rightarrow$ 3.285 MeV(6^+) $\rightarrow$ 2.283 MeV(4^+) $\rightarrow$ 1.157 MeV(2^+) $\rightarrow$ g.s.(0^+) cascade is the principal deexcitation path for the high-lying states populated via the $^{30}Si(^{16}O,2p\gamma)^{44}Ca$ reaction. The γ-γ coincidence measurements are consistent with the 5.086 MeV $\rightarrow$ 3.285 MeV transition being an $8 \rightarrow 6$ stretched quadrupole transition. (auth)

Nuclear Properties and Reactions, $59 \leq A \leq 89$

Refer also to abstracts 18533, 18540, 18577, 18578, 18582, 18586–18590, 18598, 18608, 18609, 18614, and 18638.

18596 (JINR-P4-8537) REACTIONS BETWEEN COMPLEX NUCLEI. Delchev, Ya. I; Petkov, I. Zh.; Khristov, Kh. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 33p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

A model is suggested that describes the total reaction cross section and the cross sections of complete fusion on the basis of the effective interaction. (7 figures, 3 tables) (auth)

18597 (JINR-P4-8734) ALPHA-DECAY OF COMPOUND STATES AND THE STRENGTH FUNCTION OF ALPHA-PARTICLES. Furman, V. I.; Kadmenskii, S. G.; Kholan, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The strength function for α-particles is obtained from (n, α) reaction data using the cluster model of α-decay. The analysis of this strength function gives some evidence for the existence of α-cluster levels in heavy nuclei. These levels are strongly fragmented over the compound nucleus states. (1 figure, 2 tables) (auth)

18598 (LA-5948-MS) SURVEY OF PION CHARGE-EXCHANGE REACTIONS WITH NUCLEI. Miller, G. A.; Spencer, J. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1975. Contract W-7405-eng-36. 26p. Dep. NTIS $4.00.

A survey study of the elastic charge-exchange reactions is presented. The charge-exchange cross sections are evaluated in a coupled-channel framework with optical potentials obtained from the Kisslinger and Laplacian models for the pi-nucleon off-shell scattering amplitude. Considerable differences between these two models are obtained for pion kinetic energies below the pi-nucleon (3,3) resonance. The effect of two-nucleon correlations is included by calculating the second-order pi-nucleus optical potential. We find that this effect dominates the charge-exchange reactions at energies of about 100 MeV. (30 figures, 2 tables, 36 references) (auth)

18599 (LF-48, pp 25-27) TOTAL DECAY ENERGIES OF NEUTRON-RICH NUCLIDES. Lund, E.; Rudstam, G. 1974.

In progress report, 1973.

The program for measuring total decay energies of short-lived fission products is practically completed for nuclides with half-life longer than about five seconds. Results obtained thus far are listed together with theoretical predictions from three currently accepted mass formulas. (2 tables) (SDF)

18600 (ORO-2408-104) STUDIES OF NUCLEAR PROCESSES. Progress report, June 1, 1974–May 31, 1975. Clegg, T. B.; Ludwig, E. J.; Merzbacher, E.; Shafroth, S. M.; Thompson, W. J. (North Carolina Univ., Chapel Hill (USA)). 1975. Contract AT(40-1)-2408. 39p. Dep. NTIS $5.00.

The studies of nuclear processes conducted by the Chapel Hill group affiliated with the Triangle Universities Nuclear Laboratory (TUNL) have continued to emphasize the following topics: I. Proton Beam Experiments; II. Polarized Deuteron Beam Experiments; III. Development of Ion Sources, Experimental Equipment, and Techniques; IV. Nuclear Theory and Nuclear Reaction Analyses; V. Atomic Effects in Nuclear Bombardment. The Cyclo-Graaff at TUNL and the 4-MeV Van de Graaff accelerator were the primary sources of particle beams. Computations were carried out on the computers at TUNL and at the Triangle Universities Computation Center (TUCC). Many charged particle and neutron experiments were undertaken jointly with groups from Duke University and North Carolina State University. The research program has aimed at a better understanding of the spin dependence of nuclear interactions revealed in experiments with polarized beams. Collisions between charged particles and complex atoms, leading to inner shell ionization, were studied in high resolution over a broad energy range. (auth)

18601 ROTATIONAL BANDS IN ^{79}Kr. Bharathi, S. M. (Tata Inst. of Fundamental Research, Bombay); Agarwal, Y. K.; Lal, B.; Baba, C. V. K.; Betigeri, M. G.; Puttaswamy, N. G. Pramana.; 4: No. 1, 25-37(Jan 1975).

The level scheme of ^{79}Kr has been studied through the $^{79}Br(p,n)^{79}Kr$ reaction at proton energies from 1.7 to 5.0 MeV. γ-ray and internal conversion electron measurements were made using Ge(Li) detectors and a six gap "Orange" electron spectrometer. The level scheme was established by determining the thresholds of various γ-rays and by γ-γ and n-γ coincidence measurements. New levels at 402, 450, 660, 676, 695, 720, 810, 836, 907 and 1038 keV not observed in earlier radioactivity studies have been established. Definite J^π assignments have been made to most of the levels below 800 keV. Many of the low-lying levels are identified as rotational levels based on the (301 down) $\frac{1}{2}^-$, (301 up) $\frac{3}{2}^-$ and (431 down) $\frac{1}{2}^+$ Nilsson states. (6 figures, 2 tables) (auth)

18602 CORRELATION OF PARAMETERS OF OPTICAL POTENTIAL OF ALPHA PARTICLES. Vaktybaev, K. B.; Duisebaev, A. D.; Kabulov, A. B. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 68-73(1974). (In Russian).

Possible correlations between the parameters of the optical potential of alpha particles were determined. Form factors of the real and imaginary parts of the potential were selected in a Woods-Saxon form. Errors of the reducible parameters of the complex potential for scattering of 50.5-MeV alpha particles on the ^{64}Zn nucleus were calculated. (tr-auth)

18603 COMMENT ON THE $^{87}Sr(d,p)$ REACTION. Seth, K.K. (Northwestern University, Evanston, Illinois 60201, 91 Gif-sur-Yvette, France); Buzard, K.A.; Picard, J.; Bassani, G. Phys. Rev. C 11: No. 6, 2087-2088 (June 1975).

Results for the matrix elements of the effective interaction between particles in the $d_{5/2}$ and $g_{9/2}$ orbits are modified in view of the new spin identification by Metzger. (auth)

18604 SPIN AND WIDTH OF THE 4744 keV LEVEL OF ^{88}Sr. Metzger, F.R. (Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania 19081). Phys. Rev. C 11: No. 6, 2085-2086 (June 1975).

A recent study of the $^{87}Sr(d,p)^{88}Sr$ reaction reopened the question of the spin of the 4744 keV level of ^{88}Sr. In an effort to determine this spin, the 4744 keV level has been excited using bremsstrahlung. The observed angular distribution of the resonant γ radiation is compatible only with the assignment of spin 1. With a branching ratio $\Gamma_0/\Gamma = 1$, the observed yield corresponds to a total width Γ (4744) = (95 ± 20) meV. (auth)

18605 PROTON-INDUCED REACTIONS ON ^{89}Y. Comfort, J.R.; Nathan, A.M.; Braithwaite, W.J.; Duray, J.R. (Joseph Henry Laboratories, Physics Department, Princeton University, Princeton, New Jersey 08540). Phys. Rev. C 11: No. 6, 2012-2021 (June 1975).

The reactions ^{89}Y$(p,t)^{87}$Y, ^{89}Y$(p,d)^{88}$Y, and ^{89}Y$(p,\alpha)^{86}$Sr are studied with 27.8-MeV protons and solid-state-detector telescopes. A recent revision of the mass of ^{87}Y is confirmed. Angular distributions are obtained for the observed states. Several new levels are found in ^{87}Y. The states at 0.98, 1.85, and 2.09 MeV are assigned $J^\pi = 3/2^-$, $1/2^-$, and $3/2^-$, respectively. In ^{88}Y, the existence of two low-spin states of opposite parity is established at 0.705 MeV. Distorted-wave Born-approximation (DWBA) calculations are carried out for the (p,d) and (p,t) data. Good fits to the data are obtained for the (p,d) reaction, but the $l = 4$ and $l = 1$ summed strengths deviate in opposite directions from the sum rules. Poor fits are obtained for $L = 0$ transitions in the (p,t) reaction on ^{89}Y and the experimental $L = 2$ angular distributions show features that are not reproduced by the DWBA. Multistep contributions are suggested. The data for the (p,α) reaction show some evidence for direct-reaction processes, but DWBA calculations cannot be carried out. (auth)

18606 ^{89}Y(^{3}He,t) REACTION AT 25 MeV. Greenwood, M.S.; Pluta, M. (De Paul University, Chicago, Illinois 60614; Anantaraman, N.; Greenwood, L.R. Phys. Rev. C 11: No. 6, 1995-2000 (June 1975).

Nineteen angular distributions were obtained for the ^{89}Y(^{3}He,t) ^{89}Zr reaction at 25 MeV. The angular distribution of the 0.59-MeV state, thought previously to be the antianalog state, is characterized by $L = 2$ with spin-flip. This indicates the presence of a configuration, other than the antianalog configuration, in the wave function of the 0.59-MeV state. Arguments are presented to show that the $g_{9/2} \rightarrow g_{9/2}$ transition with $L = 2$, $S = 1$ is responsible for the excitation of this state. Angular distributions leading to the ground state, the 1.514-, 2.784-, and 2.932-MeV states are very similar. Since the ground state and the 1.514-Mev state have $J^\pi = 9/2^+$, this suggests that the other states also have $J^\pi = 9/2^+$. The angular distribution leading to the ground state was not satisfactorily fitted by distorted-wave calculations, since the forward peaking corresponded to $L = 2$, rather than to the allowed $L = 3$ and $L = 5$. The structure of the $9/2^+$ states was investigated in terms of the coupling of a $g_{9/2}$ neutron hole to the 0^+ states in ^{90}Zr. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 18535, 18556, 18578, 18587, 18596, 18598–18600, 18661, 18707, and 18731.

18607 (COO-2231-25) USER ACTIVITIES AT KENT STATE UNIVERSITY. Madey, R. (Kent State Univ., Ohio (USA). Dept. of Physics). 1974. 72p. (CONF-741245-1). Dep. NTIS $6.75.

From nuclear physics seminar; Bloomington, Indiana, USA (11 Dec 1974).

Various user activities are described. Common to each measurement is the fact that a neutron spectrum is measured by the time-of-flight method. (JFP)

18608 (COO-3122-9) STUDIES OF NUCLEAR REACTIONS. Progress Report, September 1, 1974–August 31, 1975. Miller, J. M. (Columbia Univ., New York (USA)). Jun 1975. Contract E(11-1)-3122. 5p. Dep. NTIS $4.00.

The work described was carried out during the period ending on Dec. 31, 1974, at which time the Heavy Ion Linear Accelerator at Yale University was permanently phased out of operation. Work is reported in the following areas: evaporation-residue cross section from 336-MeV ^{32}S + In, nonequilibrium fission, emission of H and He in the reactions of 336-MeV ^{32}S + ^{115}In, and the ^{63}Cu(^{12}C,^{12}B) reaction. A number of cross sections are reported, but no detailed data are given. (RWR)

18609 (COO-3274-18) NUCLEAR MOMENTS AND NUCLEAR STRUCTURE. Annual Progress Report, May 1, 1974–April 30, 1975. Madansky, L.; Lee, Y. K. (Johns Hopkins Univ., Baltimore, Md. (USA)). 1975. Contract AT(11-1)-3274. 110p. Dep. NTIS $9.00.

A collection of nine papers covers linear polarization of gamma rays from high spin states produced in heavy ion reactions, nuclear moments, temperature spikes in solids following Coulomb excitation, and positron diffusion in noble gases. (SDF)

For abstracts of individual papers see: 18316, 18534, 18562, 18576, 18610–18613, and 18643.

18610 (COO-3274-18, pp 8-13) GAMMA-RAY LINEAR POLARIZATION MEASUREMENTS FOLLOWING HEAVY-ION BOMBARDMENT OF ODD ISOTOPES OF Pd. Kim, J. S.; Lee, Y. K.; Simms, P. C. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

The study of the quasirotational bands in the neutron deficient odd nuclei of palladium has been completed. A series of negative parity states were observed but are apparently not due to a quasi-rotational band. Linear polarization data is presented in tabular form for the reaction ^{90}Zr(^{12}C,3n)^{99}Pd at 56 MeV. (1 figure, 1 table) (SDF)

18611 (COO-3274-18, pp 14-23) LINEAR POLARIZATION STUDY OF HIGH-SPIN STATES IN EVEN-A PALLADIUM AND ^{156}Er. Stromswold, D.; Elliott, D.; Lee, Y. K.; Piel, W. F. Jr.; Sunyar, A. W. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

Spin and parity assignments have been made for important sidebands in the even-A isotopes ^{100}Pd and ^{102}Pd and in ^{156}Er. A partial level scheme and one sideband is shown for ^{156}Er and it is confirmed that the odd spin sequence 13^- yields 11^- yields 9^- yields 7^- may be assigned a negative parity. The 9 yields 7 yields 5 sideband in ^{100}Pd also is assigned a negative parity. Polarizations obtained for certain transitions in ^{102}Pd are given along with their assigned multipolarities. The polarization studies were carried out using the reactions ^{142}Nd(^{18}O,4n)^{156}Er at 92 MeV, ^{91}Zr(^{12}C,3n)^{100}Pd at 63 MeV, and ^{90}Zr(^{13}C,3n)^{102}Pd at 56 MeV. (2 figures, 2 tables) (SDF)

18612 (COO-3274-18, pp 24-27) LINEAR POLARIZATION OF CONTINUUM GAMMA RAYS FOLLOWING HEAVY-ION REACTIONS. Stromswold, D. C.; Elliott, D. O. Jr.; Lee, Y. K.; Sunyar, A. W. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

Linear polarization of continuum gamma rays in ^{156}Er and ^{102}Pd was studied using heavy ion reactions, and results are tabulated. The variation of the continuum polarization as a function of energy range in ^{102}Pd is not completely understood. The results also do not agree with theoretical and experimentally based predictions that the continuum should be mainly stretched E2 transitions. Suggestions for further work are given. (1 table) (SDF)

18613 (CO-3274-18, pp 101-104) POSSIBLE OBSERVATION OF LINEAR POLARIZATION FROM Nd K X-RAYS FROM HI BOMBARDMENT OF ^{142,150}Nd TARGETS. Elliott, D. O. Jr. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

In observing heavy ion bombardment of ^{142}Nd and ^{150}Nd targets, the Compton polarimeter data showed strong asymmetry for some peaks at the extreme low energy end of the spectra. These peaks correspond to K x-rays of Nd and Pb, and indicate that strong polarization should be expected. It was suggested, however, that experimental problems caused the effect. Subsequent re-examination of the problem indicates that further study is needed. (1 figure) (SDF)

18614 (IEA-351) SYSTEMATIC STUDY ON NUCLEAR RESONANT SCATTERING. Suarez, A. A.; Freitas, M. L. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Sep 1974. 36p. Dep. NTIS (US Sales Only) $4.75.

New resonant scattering effects of thermal neutron capture gamma rays from Ti and Fe on Sb, Cu, Se and Ce targets were observed. These results together with those published by other authors are summarized and discussed in terms of a possible systematic search for new resonant scattering effects. (9 figures, 1 table, 66 references) (auth)

18615 (IS-T-672) GAMMA-RAY DECAY SCHEMES FOR ^{91}Kr AND ^{91}Rb. Glascock, M. D. (Ames Lab., Iowa (USA)). May 1975. Contract W-7405-eng-82. 117p. Dep. NTIS $9.00.

Thesis.

A study of the resultant gamma-ray de-excitations following the beta decays of ^{91}Kr and ^{91}Rb using the TRISTAN on-line isotope-separator system is reported. Measurements of gamma-ray singles and gamma-gamma coincidences were performed with Ge(Li) detectors. For the decay of ^{91}Kr, 218 of 220 observed gamma-ray transitions have been assigned to a level scheme for ^{91}Rb with 60 excited states. For the decay of ^{91}Rb, 109 of 125 observed gamma-ray transitions have been assigned to a level scheme for ^{91}Sr with 37 excited states. Internal-conversion coefficients and level half-lives were measured for transitions from the first-excited states in both nuclei. Beta branchings were determined from equilibrium measurements and transition-intensity balances. Spin and parity assignments have been made using gamma-ray transition probabilities, internal-conversion coefficients, and deduced log ft values. Interpretation of some of the energy levels is made on the basis of the shell model and nuclear systematics. (19 figures, 12 tables, 49 references) (auth)

18616 (JINR-E4-8834) ANALYSIS OF SIMPLE CONFIGURATIONS IN THE CAPTURE STATE OF ZIRCONIUM AND MOLYBDENUM. Soloviev, V. G.; Voronov, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

In ^{91,93,95,97}Zr and in ^{93,95,97,99}Mo the energies of one-quasiparticle and three-quasiparticle states with $I = 1/2^+$, $1/2^-$ and $3/2^-$ near the neutron binding energy B_n are calculated. The investigations of the El and Ml-transitions from these states to one-quasiparticle components of the low-lying states are performed. The analysis of neutron and partial radiation widths is given. It is shown that the valence neutron model should work well in ^{91,93,95,97}Zr, in ^{99}Mo, and somewhat worse in ^{95,97}Mo. The values of one-quasiparticle components $^3p1/2$ and $^3p3/2$ in the wave function of P-wave resonance are estimated from the neutron and radiation widths, these are equal to $|b^-|^2$ approximately $10^{-3}-10^{-4}$. Large partial widths for the Ml-transitions from the s-wave resonances in ^{93}Zr, ^{93,99}Mo give evidence of a rather large contribution to their wave functions, corresponding to the three-quasiparticle configurations. (4 figures) (auth)

18617 (LF-48) PROGRESS REPORT, 1973. Rudstam, G. (ed.). (Forskningsraadens Lab., Studsvik (Sweden)). 1974. 50p. Dep. NTIS (US Sales Only) $5.50.

Current projects carried out by the research groups working at the Swedish Research Councils' Laboratory. A summary of the research projects of the nuclear spectroscopy, nuclear structure, neutron diffraction, nuclear chemistry and radiation chemistry groups is given together with a list of publications for 1973. A portion of this report is abstracted separately. (SW)

For an abstract of an individual section see: 18599.

18618 (NEANDC-101(U)) SEVENTH BIENNIAL REPORT ON THE ACTIVITIES OF THE EUROPEAN–AMERICAN NUCLEAR DATA COMMITTEE. Story, J. S.; Conde, H. (Organization for Economic Co-Operation and Development, 75- Paris (France)). Mar 1975. 20p. Dep. NTIS (US Sales Only) $4.00.

The activities of the European–American Nuclear Data Committee are summarized for the period 11/71 to 3/74. A list of EANDC reports issued during the period is appended. (SDF)

18619 (ORO-3398-45) RESEARCH AT THE TEXAS A AND M UNIVERSITY CYCLOTRON FOR THE PERIOD JUNE 1, 1970–DECEMBER 31, 1971. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.). Mar 1972. Contract AT(40-1)-3398. 102p. Dep. NTIS $8.25.

The 11 papers presented are abstracted separately. (SDF)

For abstracts of individual papers see: 16704, 18327–18329, 18535, 18536, 18620–18623, and 18647.

18620 (ORO-3398-45, pp 1-3) ELASTIC AND INELASTIC SCATTERING REACTIONS ON N EQUALS 82 NUCLEI. Barker, J. H.; Hiebert, J. C. Mar. 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

A study of N equals 82 nuclei has been continued by measuring the elastic and inelastic scattering of 49.6 MeV alpha particles from ^{138}Ba. The elastic angular distribution is shown with an optical model prediction using parameters from a study of ^{144}Sm, and the inelastic distribution is compared with DWBA predictions. Spin and parity assignments of 2^+, 4^+, and 3^- are confirmed for the states at 1.436, 1.898, 2.880 MeV. A comparison of ^{138}Ba level schemes with two recent shell model calculations is presented. (6 figures, 1 table) (SDF)

18621 (ORO-3398-45, pp 10-11) NEUTRON PICKUP REACTIONS TO ISOBARIC ANALOG STATES IN Mo ISOTOPES. Kozub, R. L.; Youngblood, D. H.; Keller, L. G. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

The (p,d) and (d,t) reactions on ^{92,94,96}Mo have been used to observe isobaric analog states in the residual nucleus. Data were taken with 38.6 MeV protons and 40.6 MeV deuterons. A comparison of spectroscopic strengths deduced from these two reactions is made with comparisons to parent state results. DWBA calculations were performed, and form factors were determined. It is found that the IAS strength functions from the (p,d) and (d,t) reactions decrease with increasing mass. (2 figures) (SDF)

18622 (ORO-3398-45, pp 42) DECAY OF ^{128}La. Adams, F.; Zolnowski, D. R.; Sugihara, T. T.; Meyer, R. A. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Gamma spectra from the decay of 4.6 minute ^{128}La to levels in ^{128}Ba have been analyzed, and the energies and intensities are summarized. A level scheme based on coincidence experiments is constructed. The levels at 284.0, 763.3, and 1407.2 keV appear to be the 2^+, 4^+, and 6^+ members of the ground state rotational band. (1 table, 1 figure) (SDF)

18623 (ORO-3398-45, pp 50-53) INTERNAL IONIZATION DURING THE BETA DECAY OF ^{147}Pm AND ^{99}Tc. Watson, R. L.; Chulick, E. T.; Howard, R. W. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Experiments have been performed that determined the total internal ionization probabilities for ^{147}Pm and ^{99}Tc, and that investigate the energy dependence of the process for these two nuclides. The results are compared with various theoretical results. (2 tables, 3 figures) (SDF)

18624 (ORO-3624-15) NORTH CAROLINA STATE UNIVERSITY NUCLEAR STRUCTURE RESEARCH AT THE TRIANGLE UNIVERSITIES NUCLEAR LABORATORY. Progress Report. Seagondollar, L. W.; Waltner, A. W.; Mitchell, G. E.; Tilley, D. R.; Gould, C. R. (North Carolina State Univ., Raleigh (USA)). 31 May 1975. Contract AT(40-1)-3624. 24p. Dep. NTIS $4.25.

A summary is presented of nuclear structure research completed at the Triangle Universities Nuclear Lab for the period 9/1/74 to 8/31/75. Included are abstracts and titles for studies of electromagnetic transitions in low-medium mass nuclei, high resolution studies, accelerator induced x-ray investigations, and energy related neutron and charged particle cross section measurements. (SDF)

18625 (USIP-75-03) g-FACTOR OF THE 80.1 keV LEVEL IN ^{144}Pr. Bargholtz, C.; Beshai, S.; Eriksson, L.; Froeberg, L.-E.; Gidefeldt, L. (Stockholm Univ. (Sweden). Fysiska Institutionen). Feb 1975. 10p. Dep. NTIS (US Sales Only) $4.00.

The g-factor of the 80.1 keV level in ^{144}Pr was determined in an IPAC study of the 53.4 to 80.1-keV cascade. With an external magnetic field of 21.7(3) kG the precession angle $\omega\tau$ was measured to be $-0.045(12)$. The result $g = -1.2(4)$ agrees well with that calculated in terms of coupling of the effective moments of the odd particles, $g = -1.43(7)$. From the directional correlation of the 53.4 to 80.1-keV cascade the mixing ratio of the 53.4-keV transition was determined, $\delta(E2/M1) = 0.043(3)$. (auth)

18626 (USIP-75-05) UNIFIED MODEL CALCULATIONS IN INTERMEDIATE COUPLING APPLIED TO THE LOW ENERGY SPECTRA OF ^{103}Rh AND ^{99}Tc. Bargholtz, C. (Stockholm Univ. (Sweden). Fysiska Institutionen). Feb 1975. 34p. Dep. NTIS (US Sales Only) $4.75.

The low energy properties of ^{103}Rh and ^{99}Tc are studied in a unified model calculation. The negative parity states are described as a proton quasi-particle in the $p_{\frac{1}{2}}$, $p_{\frac{3}{2}}$ and $f_{\frac{5}{2}}$ orbitals coupled to the quadrupole oscillations of the core. For the positive parity states $(g_{\frac{9}{2}})n_J$ configurations are coupled to the vibrations. The parameters of the model are determined by a fit to experimental energies and electromagnetic moments of states in ^{103}Rh. The properties of ^{99}Tc are then calculated without any adjustable parameters. A rather good agreement with experiment is obtained. (auth)

18627 (UUIP-873) TRANSITION RATES BETWEEN THE POSITIVE PARITY STATES IN ^{101}Tc. Svensson, L.-G.; Baecklin, A.; Solhed, H.; Lindskog, J. (Uppsala Univ. (Sweden). Fysiska Institutionen). Apr 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The half-lives of the 15.6-keV $5/2^+$ and the 9.3-keV $1/2^+$ levels in ^{101}Tc were measured by means of delayed electron-electron coincidence technique. The obtained half-lives were 26.8 ± 0.6 ns and 14.3 ± 0.3 ns respectively. The results are discussed in terms of current nuclear models. (auth)

18628 (UUIP-881) EXCITED LEVELS OF ^{111}In AND ^{113}In. Dietrich, W.; Baecklin, A. (Uppsala Univ. (Sweden). Fysiska Institutionen). Oct 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

Levels and transitions in ^{111}In and ^{113}In have been studied through the ^{111}Cd(p,nγ)^{111}In and ^{113}Cd(p,nγ)^{113}In reactions. By means of γ-γ coincidences, γ-angular distributions, relative excitation functions, and conversion electron measurements, more than 20 levels below 2 MeV have been established in each nucleus. Several negative-parity states were found above 1 MeV. Two low-spin positive-parity states with features similar to the possible rotational band in the heavier In nuclei are observed below 1400 keV in both nuclei. (11 Figures, 1 table, 36 references) (auth)

18629 (UUIP-882) EXCITED STATES IN ^{103}Pd. Dietrich, W.; Nyman, B.; Johansson, A.; Baecklin, A. (Uppsala Univ. (Sweden). Fysiska Institutionen) Oct 1974. 38p. Dep. NTIS (US Sales Only) $5.00.

The level scheme of $^{103}_{46}$Pd has been investigated by means of gamma-ray and internal conversion measurements in the ^{103}Rh (p,nγ) reaction and the ^{103}Ag decay. A revised and much enlarged

^{103}Pd level scheme has been constructed. Tentative spin-parity assignments, derived from relative excitation functions, transition multi-polarities and log ft values, have been given for the majority of the 25 levels observed in the reactions. A half-life of 25 ± 2 ns was measured for the $11/2^-$ level at 784 keV. (12 figures, 5 tables) (auth)

18630 (UUIP-883) STUDY OF THE LOW-LYING STATES IN ^{107}Cd. Dietrich, W.; Baecklin, A. (Uppsala Univ. (Sweden). Fysiska Institutionen). Nov 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

Levels and transitions in ^{107}Cd have been studied by means of γ-γ coincidences, γ-angular distributions and conversion electrons in the ^{107}Ag(p,nγ)^{107}Cd reaction. Spin and parity assignments have been proposed to the 27 levels investigated. A lifetime of 65 ± 6 ns was measured for the $11/2^-$ isomer at 845 keV by the pulsed beam delayed coincidence technique. The positive parity states show qualitative agreement with the weak-coupling model. A $3/2^-$ state is observed only 368 keV above the $11/2^-$ state. (8 figures, 2 tables) (auth)

18631 (WAPD-T-2542) DECAY OF 3.84 MeV LEVEL OF ^{90}Zr AND INELASTIC NEUTRON SCATTERING FROM ^{91}Zr. Glickstein, S. S.; Tessler, G. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). 1972. Contract AT(36-1)-GEN-14. 20p. (CONF-740201-6). Dep. NTIS $4.00.

From topical conference on energy; Chicago, Illinois, USA (4 Feb 1974).

In reported results for the gamma ray production cross-section measurements of the ^{90}Zr(n,n'gamma) reaction, considerable disagreement was observed between the measurement and calculations for the 3.84 MeV gamma ray production cross section. It was conjectured that there exist modes of decay of the 3.84 MeV level, other than the direct transition to the ground state. The ^{90}Zr(n,n'gamma) spectra at E/sub n/ equals 4.5 MeV was measured with an improved Ge(Li) experimental arrangement and a weak gamma ray was detected at 2.076 MeV which is believed to decay from the 3.836 (2+) MeV level to the 1.761 (0+) of ^{90}Zr. From the relative intensities of the 3.836 and 2.076 MeV gamma rays, the branching ratios of the 3.836 MeV level to the ground state have been determined to be 0.58. This is precisely what is needed to explain the difference between measurement and calculation in the original investigation. In ^{91}Zr, calculations and measurements for gamma ray production cross sections are presented for the 652, 660, 713, 726, 792, 796, 1151, 1204.7, 1466.4, 1882.2, 2042.5, 2131.4, 2169.7, 2190.1, 2200.7, and 2367 keV gamma rays, for incident neutron energies up to 6.2 MeV. (13 figures) (auth)

18632 GAMMA-RAY TRANSITIONS POPULATED BY THE DECAY OF ^{116m}In. Chung, M. K.; Cho, S. W. J. Korean Phys. Soc.; 7: No. 1, 22-29(1974).

The gamma radiation associated with the beta decay of ^{116m}In to levels in ^{116m}Sn has been studied with Ge(Li) singles and Ge(Li) NaI coincidence measurements. Nine previously unreported transitions were observed with energies of 277.799, 303.297, 655.946, 688.666, 705.301, 780.734, 972.632, 1361.307 and 2226.545 keV and their relative intensities were determined. Six transitions, except three gamma-rays observed at 655.946, 705.301 and 136.307 keV are placed in a level scheme of ^{116}Sn consisting of the levels at 1293.74(2^+), 1757.15(0^+), 2112.32(2^+), 2226.22(2^+), 2265.94(3^-), 2390.94(4^+), 2529.44(4^+), 2800.74(4^+) and 3046.35(4^+) KeV. In the present work, the 2226.55 keV (2^+) and 2265.99 keV (3^-) states that have been observed in the ^{115}Sn (n,γ) experiments, but not yet been found in the decay of ^{116m}In, are proposed to participate in the well-established decay scheme of ^{116m}In. The results are compared with those of previous studies. (auth)

18633 53 MeV ^{3}He SCATTERING FROM SAMARIUM ISOTOPES. Eagle, R. (King's Coll., London); Clarke, N. M.; Griffiths, R. J.; Fulmer, C. B.; Hensley, D. C. J. Phys., G (London); 1: No. 3, 358-361(1 Apr 1975).

Measurements have been made of the differential cross sections for ^{3}He scattering from the samarium isotopes Sm 144, 148, 150, 152, 154 at 53.4 MeV. An optical model analysis has been performed to compare with similar analyses using proton and alpha beams at the same energy. (auth)

18634 NUCLEAR PHYSICS. Joint Meeting of the German Physical Society and the Netherlands Physical Society, The Hague, Netherlands, April 1975. Verhandlungen der Duetschen Physikalischen Gesellschaft, No. 7. Weinheim, Ger.; Physik Verlag GmgH (1975). 208p. (In German and English). (CONF-750448-(Absts.)).

A collection of titles and abstracts of nuclear physics papers presented at the joint meeting of the German Physical Society and the Netherlands Physical Society, April, 1975, is presented in book form. (SDF)

18635 REACTION LIST FOR CHARGED-PARTICLE-INDUCED NUCLEAR REACTIONS: Z EQUALS 1 TO Z EQUALS 98 (H TO Cf), JULY 1973–SEPTEMBER 1974. McGowan, F. K.; Milner, W. T. (Oak Ridge National Lab., TN). At. Data Nucl. Data Tables; 15: No. 3, 189-303(Mar 1975).

This reaction list for charged-particle-induced nuclear reactions has been prepared from the journal literature for the period from July 1973 through September 1974. Each published experimental paper is listed under the target nucleus in the nuclear reaction with a brief statement of the type of data in the paper. The nuclear reaction is denoted by A(a,b)B, where the mass of a is greater than or equal to (one nucleon mass). There is no restriction on energy. Nuclear reactions involving mesons in the outgoing channel are not included. Theoretical papers which treat directly with the analysis of nuclear reaction data and results are included in the Reaction List. The cutoff date for literature was September 30, 1974. (auth)

18636 DOUBLE CONVERSION. Drukarev, E. G. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 21: No. 3, 593-603(Mar 1975). (In Russian).

The double KK and KL conversion at the nuclear transition energy much more than the ionization potential is considered. Simple formulas for the total probability and for the energy distribution are obtained. The probability is also calculated for the conversion accompanied by excitation of a discrete level. (auth)

18637 STUDY OF INELASTIC PROTON SCATTERING AT ISOBARIC ANALOG RESONANCES. Davis, S. L. New Brunswick, NJ; Rutgers–The State Univ. (1974). 150p. University Microfilms Order No. 75-8388.

Thesis (Ph. D.).

Inelastic proton scattering at isobaric analog resonances (IAR's) was studied using the targets ^{138}Ba and ^{92}Mo. Differential cross sections and analyzing powers were measured at the 10.00, 10.63, 11.09, 11.45, and 11.70 MeV resonances in ^{138}Ba + p and at the 5.89, 6.09, and 6.55 MeV resonances in ^{92}Mo + p. In addition, a new measurement, the spin flip asymmetry, was developed. The experiment was performed by using a polarized beam to make spin flip measurements. Angular distributions for the spin flip probability and spin flip asymmetry were measured at all of the above energies except for the lowest three resonances in ^{138}Ba, where only the spin flip probability was measured. A DWBA code modified to include the coherent addition of resonance amplitudes was used to analyze the ^{138}Ba data. The partial widths extracted from this analysis were converted to expansion coefficients for parent states in ^{139}Ba. The coefficients were found to be in good agreement with unified model calculations. For ^{92}Mo, inelastic polarizations, deduced from the spin flip and spin flip asymmetry, were found to be large. Attempts using Hauser Feshbach theory to describe both the cross section and polarization data repeatedly failed for both the 6.55 and 5.87 MeV IAR's. This failure represents strong evidence that Hauser Feshbach theory is not valid when extended to describe scattering at an IAR. The ^{92}Mo data were analyzed using a reaction theory modified to include channel-channel correlations. This theory predicts that the enhanced compound scattering is identical to the resonance scattering. Good fits have been obtained with the use of this modified Hauser Feshbach theory. (Diss. Abstr. Int., B)

18638 ISOBARIC ANALOGUE RESONANCES IN YTTRIUM AND IODINE. van Eeghem, W. P. T. M. Eindhoven, Netherlands; Technische Hogeschool (1975). 99p.

Thesis.

The work described in this thesis deals with isobaric analogue resonances observed in the differential cross section for scattering of protons from heavier nuclei (N, Z). From the study of these resonances, occurring in the continuum spectrum of the compound nucleus (N,Z+1), information can be obtained on bound states (parent states) of the isobaric nucleus (N+1,Z). In chapter 1 attention is paid to the description of such resonances in terms of the Lane model. Furthermore, we describe what kind of information on the parent states can be extracted from the various experiments. In chapter 2 experimental results on elastic scattering of unpolarized protons from ^{84}Sr are given and analyzed. From this analysis optical model and resonance parameters are found. A compound contribution to the cross section is included in the resonance analysis. Spectroscopic factors have been calculated using modified R-matrix theory as well as the Lane model. Chapter 3 describes the experimental procedure in performing experiments with a polarized proton beam. The polarized proton source is described briefly. Chapters 4 and 5 deal with elastic scattering of polarized protons from the isotopes ^{84}Sr, ^{86}Sr and ^{130}Te, ^{128}Te, ^{126}Te, ^{124}Te, respectively. For most of the resonances studied the total angular momentum J could be determined. The spectroscopic factor S_{pp} can be calculated from the product $(2J+1)S_{pp}$, known from unpolarized proton experiments. Chapter 6 presents the study of inelastic scattering of polarized protons from the first excited state of ^{126}Te. A method was developed and

applied to extract partial width amplitudes from measured cross sections and analyzing powers. From these amplitudes coefficients of fractional parentage are derived, characterizing the relation between one of the parent states in ^{127}Te and the first excited state of ^{126}Te. (NL)

18639 DOUBLET SPLITTINGS IN ^{90}Y. Kumar, N. (Indian Inst. of Tech., Kanpur, India). Indian J. Pure Appl. Phys.; 13: No. 4, 267-269(Apr 1975).

It is shown that, with a proper choice of the exchange character, negative-parity doublet splittings of ^{90}Y can be well explained with central forces alone. (auth)

18640 A STUDY OF THE EXCITED LEVELS IN ^{119}Sb. I. The Radioactive Decays of ^{119m}Te and ^{119g}Te. Duffait, R.; Charvet, A.; Chery, R. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Z. Phys., A; 272: No. 3, 315-319 (Mar 1975).

The radiative decays of 4.7 d isomeric ^{119}Te and 16 h ground state ^{119}Te were reinvestigated. Compared to previous investigations, almost twice as many transitions were observed. Revised decay schemes are proposed in which most of the observed transitions are attributed. The half-lives of the levels at 270.45 keV (g, 7/2), 644.01 keV (s1/2), 1,212.69 keV (3/2$^+$) and 1,366.15 keV (h11/2) were measured by means of the delayed coincidence method and found to be 35 ± 10 ps, < 10 ps, < 10 ps and 112 ± 15 ps respectively. The states are discussed in the framework of current models. (auth)

18641 A STUDY OF THE EXCITED LEVELS IN ^{119}Sb. II. Doppler Shift Measurements with the ^{119}Sn(p,nγ)^{119}Sb Reaction. Duffait, R.; Charvet, A.; Chery, R. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Z. Phys., A; 272: No. 3, 321-324(Mar 1975).

The lifetimes of a number of levels in ^{119}Sb have been measured with the Doppler shift attenuation method (DSAM) using the ^{119}Sn (p,nγ)^{119}Sb reaction and observing the γ-rays emitted by the ^{119}Sb nuclei recoiling in the self-supporting ^{119}Sn target. (GE)

18642 *K* INTERNAL-CONVERSION COEFFICIENT OF THE *M*4 65-keV TRANSITION IN ^{119}Sn. Abreu, M.C.; Godinho, M.M.; Gil, F.B (Laboratório de Física, Grupo de Espectroscopia Nuclear, Faculdade de Ciências da Universidade de Lisboa, Lisbon-2, Portugal). Phys. Rev. C 11: No. 6, 2103-2104 (June 1975).

The α_K coefficient of the 65-keV *M*4 transition in ^{119}Sn was measured. The result is $\alpha_K = 1610 \pm 82$ which shows a 3% deviation from the theoretical value of Hager and Seltzer. This deviation agrees with the systematic behavior of *E*3 and *M*4 conversion coefficients. (auth)

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Refer also to abstracts 18528, 18587, 18596, 18597, 18600, 18611, 18613, 18633, and 18659.

18643 (COO-3274-18, pp 58-74) VERY SHORT-LIVED RADIATION EFFECTS IN SOLIDS FOLLOWING COULOMB EXCITATION. Chien, C. L.; Walker, J. C. 1975.

In nuclear moments and nuclear structure. Annual progress report, May 1, 1974–April 30, 1975. (Johns Hopkins Univ., Baltimore, Md. (USA)).

The simple thermal theory of Seitz and Koehler is adopted to predict the decrease in observed recoil free fraction expected when one observes the Moessbauer effect following Coulomb excitation of odd isotopes of several rare earths. Experiments were performed to investigate five short-lived Moessbauer transitions in the rare earth isotopes ^{165}Ho(97 keV,2 psec), ^{167}Er(79 keV,100 psec), ^{173}Lu(113 keV,100 psec), ^{173}Yb(78.7 keV,40 psec), and ^{159}Tb(58 keV,130 psec). Results are presented for metal and oxide targets at both low and elevated temperatures. (6 figures, 1 table) (SDF)

18644 (JINR-P4-8723) EFFECT OF THE CONTINUOUS SPECTRUM ON THE ONE-PARTICLE STATE PROPERTIES OF A DEFORMED NUCLEUS. Jamalejev, R. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The effect of the continuous spectrum on the one-particle state properties of a deformed nucleus are studied. It is shown that taking into account of the spectrum improves the agreement of the theoretical calculations with experimental data. (4 tables, 3 figures) (auth)

18645 (LA-5793) EVALUATION OF GAMMA-RAY PRODUCTION CROSS SECTIONS FROM NEUTRON-INDUCED REACTIONS ON TUNGSTEN. Young, P. G. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 27p. Dep. NTIS $4.00.

An evaluation of neutron-induced gamma-ray production cross sections and secondary spectra for the major tungsten isotopes has been completed for neutron energies from 10^{-5} eV to 20 MeV. The evaluation for energies in the keV region is based on calculations. In the thermal and MeV regions, the evaluation is based on experimental data for natural tungsten that were fitted with a simple statistical theory. This theory facilitates smoothing and extrapolation to unmeasured neutron and gamma-ray energies and allows derivation of the constituent ^{182}W, ^{183}W, ^{184}W, and ^{186}W data from the natural element measurements, thus enabling the gamma-ray evaluation to be combined with recent evaluations of isotopic neutron-production cross sections performed elsewhere. (43 figures, 2 tables) (SDF)

18646 (ORNL-TM-4881) gamma-RAY TRANSITIONS IN ^{181}Ta OBSERVED IN ^{181}Ta(n,n'gamma) REACTIONS. Dickens, J. K.; Slaughter, G. G. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 23p. Dep. NTIS $4.25.

The level structure of ^{181}Ta has been studied by observing gamma radiation due to inelastic neutron scattering by Ta. Of the 131 gamma rays (or groups of unresolved gamma rays) observed, 60 could be placed as transitions among 42 levels in ^{181}Ta. These include 24 new levels having E/sub x/ greater than 990 keV, and verification of previously reported results. Possible quantum assignments based upon the Nilsson single-particle rotational bands are suggested for 4 of the new levels. (5 figures, 1 table) (auth)

18647 (ORO-3398-45, pp 40) LEVELS IN ^{150}Gd. Haenni, D. R.; Sugihara, T. T.; Bowman, W. W.; Zolnowski, D. R. Mar 1972.

In research at the Texas A and M University cyclotron for the period June 1, 1970–December 31, 1971.

Decay studies of 3.6 hour ^{150}Tb are analyzed and a partial decay scheme based on incomplete data is presented. Spins and parities of the levels are not yet well established. (1 figure, 1 table) (SDF)

18648 (UCRL-Trans-10845) LEVEL DENSITY OF ODD-ODD DEFORMED NUCLEI. Voronov, V. V.; Malov, L. A.; Soloviev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 2 Jul 1974. Translation of JINR-P4-8102. 6p. Dep. NTIS $4.00.

The level density for doubly odd deformed nuclei near the neutron binding energy, B/sub n/, was calculated in the framework of the semimicroscopic approach. The calculated values were found to be in agreement with the experimental ones. It was shown that for the I greater than or equal to 1 states it is important to take into account rotational motion. (1 table) (auth)

18649 (UUIP-872) NUCLEAR LIFETIME MEASUREMENTS ON SOME EXCITED STATES IN ^{187}Re. Darwish, S. M.; Svensson, L.-G.; Lindskog, J.; Solhed, H.; Jonsson, N.-G. (Uppsala Univ. (Sweden). Fysiska Institutionen). Apr 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

Earlier measurements on half-lives of the 686-, 623-, and 618-keV levels in ^{187}Re showed remarkable disagreements. The main object of this investigation was to remeasure these half-lives by means of the delayed coincidence method utilizing a long-lens electron-electron spectrometer. The half-lives of these levels were measured as being: 686 keV level: $T_{\frac{1}{2}} = 10 \pm 3$ ps, 625 keV level: $T_{\frac{1}{2}} = 548 \pm 20$ ps, 618 keV level: $T_{\frac{1}{2}} \leq 50$ ps. (auth)

18650 PROTON SEPARATION ENERGIES FOR SOME RARE EARTH ISOTOPES. Burke, D. G.; Balogh, J. M. (McMaster Univ., Hamilton, Ont.). Can. J. Phys.; 53: No. 10, 984-953(15 May 1975).

Reaction Q values for the (^{3}He,d) and (α,t) single proton transfer reactions on targets of Gd, Dy, Er, and Yb have been measured with a magnetic spectrograph. Proton separation energies, S_p, are presented for ^{156,157,158,159,161}Tb, ^{161,162,163,164,165}Ho, ^{165,167,168,169,171}Tm, and ^{171,172,173,174,175,177}Lu. Although the uncertainties of the absolute Q values are approximately 15 keV, the use of isotopically mixed and natural targets resulted in probable errors of only 1–3 keV for the differences in Q values of the isotopes identified in each target. As the proton separation energy was previously known to within 1–3 keV for one isotope of each element studied, it is now possible to present S_p values with errors of a few keV for all the nuclides listed above. (auth)

18651 FISSION OF ^{189}Ir AND ^{191}Ir IN THE (α,f) REACTION. Itkis, M. G.; Kochetkov, V. L.; Okolovich, V. N.; Rus'kina, G. Ya. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 55-62(1974). (In Russian).

The total fission cross-sections of the reactions ^{185}Re (α,f) and ^{187}Re(α,f) for 28- to 50-MeV α particles were measured in the isochronous cyclotron of the KozSSR Academy of Sciences. Analysis of the experimental data gave values of 22.6 and 23.2 MeV for the effective fission barriers of ^{189}Ir and ^{191}Ir, respectively, and critical energies of nuclear phase transition from the

superfluid state to Fermi gas of 9 and 9.5 MeV. Comparison of the effective fission barriers obtained from low-energy measurements and from analysis of the gamma$_f$/gamma$_n$ energy dependence above critical energies of phase transition led to conclusions concerning the very low value (< 1 MeV) of the shell at the saddle point for ^{189}Ir. (tr-auth) (4 figures, 2 tables) (tr-auth)

18652 EFFECTIVE MOMENT OF INERTIA OF PRE-ACTINIDE NUCLEI. Okolovich, V. N.; Rus'kina, G. Ya. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 81-83(1974). (In Russian).

Results are presented of the treatment, by statistical theory, of the angular dispersion of fragments in the fission of 23 pre-actinide nuclei with 28- to 50-MeV alpha particles. These results are shown in the form of the dependence of the effective moment of inertia, j, on the energy of activation, E, and the parameter Z^2/A. For nuclei with $Z \leq 80$, the experimental dependence of the effective moment of inertia on Z^2/A does not agree with theoretical calculations according to the liquid drop model. The dependence of j on the activation energy is steeper for odd nuclei. A correlation is shown for the phase transition that appears in J (E) and the energy dependence of the parameter of the level density in the fission channel obtained from processing γ_f/γ_n data. (tr-auth)

18653 $\gamma\gamma$-DIRECTIONAL CORRELATIONS IN ^{155}Gd. Krell, H. J.; Hofmann, S. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 272: No. 3, 257-261 (Mar 1975). (In German).

Two Ge(Li) detectors were used to investigate γ transitions in ^{155}Gd produced by the decay of ^{155}Eu. Relative intensities were determined for the weak lines at 18.8, 26.5, 58.0, and 86.0 keV. Angular correlations for four γ cascades were measured. As results, the mixing ratios of the 45.3- and 86.5-keV γ lines were determined, and it was shown that the sign of the mixing ratio is positive for the γ line at 18.8 keV and negative for the line at 60.0 keV. Spins $^5/_2$ and $^3/_2$ for the 86.5 and 105.3 keV levels, respectively, are consistent with the data, and spin $^5/_2$ for the $^{105}/_3$-keV level is inconsistent with it. (auth)

18654 K CONVERSION COEFFICIENT NEAR THRESHOLD, MEASURED AFTER THE DECAY OF ISOMERIC ^{174}Lu. Kirschner, H.; Ok, A. (Goettingen Univ. (F. R. Germany). 2. Physikalisches Inst.). Z. Phys., A; 272: No. 3, 287-290(Mar 1975). (In German).

The K conversion coefficient of the 67.075 keV-transition of isomeric ^{174}Lu has beem measured to be $\alpha = 11.01 \pm 0.44$. The half-life and relative γ-intensities were also determined. (GE)

18655 NON-ADIABATIC EFFECT ON THE COLLECTIVE G-FACTOR AND THE K-FORBIDDEN M1 TRANSITION IN ^{168}Er. Ikegami, H.; Morinobu, S.; Katayama, I.; Miyokawa, T. (Osaka Univ. (Japan)). Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 132-136(Jul 1974).

The I-dependence of the reduced spin rotation g/Q_0^2 was observed for the ground-state rotational band of ^{168}Er. The M1-admixture in the interband $K = 2 \rightarrow K = 0$ transition was found to be three orders of magnitude larger than that expected from the direct band-mixing theory. These facts show that the role of the mixing of states with $K = 1$ (the core polarization) and/or the Coriolis anti-pairing are of particular importance in the magnetic properties of the collective states. (auth)

18656 *E2* AND *E4* TRANSITION MOMENTS IN ^{172}Yb, ^{174}Yb, AND ^{176}Yb. Wollersheim, H.J.; Wilcke, W.; Elze, T.W. (Institut für Kernphysik der Universität Frankfurt/Main, Germany). Phys. Rev. C 11: No. 6, 2008-2011 (June 1975).

Electric quadrupole and hexadecapole transition matrix elements in the ground-state rotational bands of ^{172}Yb, ^{174}Yb, and ^{176}Yb were measured in precise Coulomb excitation experiments with 13 MeV α particles. The results are $\langle 2^+ | M(E2) | 0^+ \rangle = 2.456 \pm 0.012$ eb, 2.439 ± 0.012 eb, 2.325 ± 0.018 eb and $\langle 4^+ | M(E4) | 0^+ \rangle = 0.22_{-0.18}^{+0.12}$ eb^2, $0.21_{-0.18}^{+0.14}$ eb^2, $0.28_{-0.20}^{+0.11}$ eb^2 for ^{172}Yb, ^{174}Yb, and ^{176}Yb, respectively. Model-dependent charge deformation parameters, β_2 and β_4, are deduced from the measured transition moments. (auth)

18657 NEUTRON RESONANCE SPECTROSCOPY: ^{177}Hf. Liou, H.I.; Rainwater, J.; Hacken, G.; Singh, U.N. (Columbia University, New York, New York 10027). Phys. Rev. C 11: No. 6, 2022-2026 (June 1975).

High resolution neutron time of flight spectroscopy measurements were made for a sample enriched in ^{177}Hf using the Columbia University Nevis synchrocyclotron. The measurements used the 202.05 m flight path for transmission measurements and the 39.37 m flight path for capture measurements. We obtain (E_0, $g\Gamma_n^0$) resonance parameters for 176 levels in ^{177}Hf to 700 eV and 12 levels in ^{178}Hf to 720 eV. We also obtained Γ_γ values for 25 levels in ^{177}Hf, giving $\langle \Gamma_\gamma \rangle = 65$ meV. The s wave strength function for ^{177}Hf is found to be (2.70 ± 0.25). Most s levels were detected to 100 eV, but many were missed above 100 eV. An analysis favors $\langle D_0 \rangle = (2.22 \pm 0.13)$ eV for the "true" s level spacing in ^{177}Hf. The results to 100 eV are in reasonable agreement with predictions for statistical orthogonal population ensembles. (auth)

18658 DECAY OF THE 1.7-h ISOMER OF ^{186}Ir. Yates, S.W. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439); Cunnane, J.C.; Daly, P.J. Phys. Rev. C 11: No. 6, 2034-2039 (June 1975).

Levels in ^{186}Os populated in the decay of 1.7-h ^{186}Ir have been studied by high-resolution γ-ray singles and γ-γ coincidence spectroscopy. Many γ rays have been assigned to this decay and several new levels in ^{186}Os have been established. On the basis of the observed decay properties and level systematics, a spin-parity assignment of 2^- and the Nilsson configuration $\{3/2 + [402]\pi, 7/2 - [503]\nu\}$ are suggested for 1.7-h ^{186}Ir. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 18528, 18540, 18587, 18651, 18652, and 18672.

18659 (CONF-750126-1) NEW ISOTOPE ^{193}Pb AND THE STRUCTURE OF ^{193}Tl; SHAPE COEXISTENCE IN ^{189}Hg AND IN ^{189}Au; AND A NEW ION SOURCE: RECENT UNISOR RESEARCH. Hamilton, J. H.; Baker, K. R.; Bingham, C. R. (UNISOR, Oak Ridge, Tenn. (USA)). 1974. 43p. Dep. NTIS $5.25.

From 25th annual national conference of the academy of sciences USSR on nuclear spectroscopy and structure of the atomic nucleus; Leningrad, USSR (Jan 1975).

The improved UNISOR ion source and some of the recent detailed investigations are briefly described. Identification and study of the ^{193}Pb high spin isomer and level structure of ^{193}Tl are discussed. A short summary is given of the work done on the coexistence of spherical and deformed bands in ^{189}Hg, and the A equals 189 mass chain, ^{189}Tl yields ^{189}Hg yields ^{189}Au, is examined using the ^{181}Ta(^{16}O,8n) and ^{181}Ta(^{16}O,P7n) reactions. Basic features of the decay chain are presented. Finally, comments on future study are offered. (19 figures, 1 table, 47 references) (SDF)

18660 (COO-1505-78) DEEXCITATION PROCESSES IN NUCLEAR REACTIONS. Progress Report, May 1, 1974–April 30, 1975. Porile, N. T. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). 1975. Contract AT(11-1)-1505. 30p. Dep. NTIS $4.50.

The following studies of charge dispersion and recoil properties in the interaction of ^{197}Au and ^{238}U with 1-300 GeV protons are described: an investigation of the charge dispersion and recoil properties of A equals 131 nuclides formed in the interaction of ^{197}Au with 11.5 GeV protons; comparative measurements at 11.5 and 300 GeV of cross sections of products in the A approximately 130 mass region formed from both gold and uranium; differential ranges of ^{131}La, ^{131}Ba, and ^{140}Ba from the reaction of ^{238}U with 11.5 GeV protons; energy dependence of recoil properties and cross sections of various scandium, gallium, and A equals 131 nuclides produced in reactions of ^{238}U with 1-300 GeV protons. A study of the interaction of silver with 25 GeV ^{12}C ions is described. Results of a study of ^{24}Na production in reactions of intermediate-energy pions and protons are presented. Studies of isospin mixing in the decay of ^{64}Zn and ^{111}In compound nuclei are described. The relative importance of compound and precompound mechanisms in the (p,p'), (p,alpha), (alpha,p), and (alpha,alpha') reactions of even-A zinc isotopes is being examined by means of measurements of energy spectra and angular distributions of the emitted particles. (5 figures) (auth)

18661 RADIOCHEMICAL STUDIES OF SOME LOW AND MEDIUM ENERGY NUCLEAR REACTIONS PRODUCED BY ACCELERATED TRITONS, DEUTERONS, AND PROTONS. Casella, V. R. Laramie, WY; Univ. of Wyoming (1974). 168p. University Microfilms Order No. 75-12,828.

Thesis (Ph. D.).

Excitation functions have been measured for the production of ^{196}/sup g/Au, ^{196}/sup m/Au, ^{198}/sup g/Au, ^{198}/sup m/Au, ^{199}Au, ^{195}/sup g/Hg, ^{195}/sup m/Hg, ^{197}/sup g/Hg, ^{197}/sup m/Hg and ^{199}/sup m/Hg by 6- to 24-MeV deuteron and triton bombardments of stable ^{197}Au. The radioactive products were determined by measurement of their characteristic gamma-rays on a Ge(Li) detector-pulse height analyzer system. The experimental results have been compared with results of compound-nucleus calculations incorporating preequilibrium particle emission. E3 isomeric states of ^{89}Y and ^{101}Ag have been discovered. These activities were produced by short bursts of beam on isotopically enriched targets; the decay gamma-rays were measured with a Ge(Li) detector-PHA system operated by a computer arrangement. Hindrance factors for the E3 transitions were calculated and discussed. Chemical procedures

have been developed for the isolation of spallation-produced radioyttrium and radiopotassium from molybdenum and vanadium targets, respectively. These procedures incorporate precipitation, solvent extractions, and ion exchange techniques. The interaction of 800-MeV protons with a thin vanadium target was studied, and cross sections for the formation of ^{42}K and ^{43}K were measured. (auth)

18662 ASYMMETRY IN THE PHOTONUCLEON ANGULAR DISTRIBUTIONS. Carbone, M. (Univ., Genoa); Cenni, R.; Malvano, R.; Molinari, A. Nuovo Cim.; 27A: No. 1, 60-72(1 May 1975).

The angular distribution of the neutrons and protons emitted in the (γ,n) and in the (γ,p) reactions is investigated in the frame of the particle plus core nuclear model. The collective dipole and quadrupole degrees of freedom of the core are explicitly taken into account. As an application it is shown that the photoneutrons peak forward in some energy range of the incident photons. (6 fig., 2 tables) (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 18502, 18535, 18587, 18660, and 18689.

18663 (CEA-CONF-2975) (n,γf) REACTION INDUCED BY SLOW NEUTRONS IN ^{239}Pu AND ^{235}U. Trochon, J.; Simon, G.; Sukosd, C. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France); CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). 1974. 14p. (CONF-7409106-8). Dep. NTIS (US Sales Only) $4.00.

From international symposium on neutron induced reactions; Smolenice, Czechoslovakia (1 Sep 1974).

The number of prompt neutrons and the number and total energy of γ-rays emitted per fission for the ^{239}Pu (n,f) and ^{235}U (n,f) reactions in the resonance energy region have been measured using the 60 MeV linac as a pulsed neutron source. The data show fluctuations of these quantities from one resonance to another, strongly correlated to the fission width. It is found to depend on the competition between γ-ray emission and fission in the decay of the compound nucleus. As confirmed by the experimental results, this interpretation leads to a constant value of the product of $\text{gamma}_{\gamma f}$ and $e_{\gamma f}$ for each spin state of a given nucleus, where $\text{gamma}_{\gamma f}$ is the width of the (n, γf) reaction and $e_{\gamma f}$ the average energy value of the prefission γ-ray spectrum. A set of parameters has been determined such that the experimental results for both nuclei can be calculated from the same model. These calculations are discussed in terms of a single and a double-humped fission barrier. (2 figures, 4 tables) (auth)

18664 (INDC(CCP)-65/U) NUCLEAR PHYSICS RESEARCH IN THE USSR. Collected Abstracts, Issue 19. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Apr 1975. Translated from Russian. 14p. Dep. NTIS (US Sales Only) $4.00.

A collection of 11 abstracts having to do with properties and fission reactions of heavy isotopes is assembled. Included are two abstracts of papers on maximum likelihood theory. (SDF)

18665 (JINR-E7-8590) PROTON PICK-UP IN THE INTERACTION OF ^{40}Ar WITH ^{232}Th. Artukh, A. G.; Gridnev, G. F.; Mikheev, V. L.; Volkov, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 18p. Dep. NTIS (US Sales Only) $4.00.

In the bombardment of a ^{232}Th target by 388 MeV ^{40}Ar ions the production of elements ranging from K to Fe has been recorded using the ΔE,E technique. The cross sections for the pick-up and stripping of the same numbers of protons turned out to be close. It is shown that a deep inelastic direct process is the main mechanism of the formation of reaction products as a result of the pick-up of ≥ 2 protons. (4 figures, 1 table) (auth)

18666 (JINR-E15-8628) MUON-INDUCED FISSION OF ^{237}Np, ^{242}Pu, AND ^{239}Pu. Aleksandrov, B. M.; Buklanov, G. V.; Fromm, W. D.; Ganzorig Dz.; Krivokhatskii, A. S.; Krogulski, T.; Polikanov, S. M.; Sabirov, B. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 10p. Dep. NTIS (US Sales Only) $4.00.

The absolute yields of prompt and delayed fission induced by negative muons in ^{237}Np, ^{242}Pu, and ^{239}Pu have been measured and compared with the photofission data. (3 figures) (auth)

18667 (JINR-P4-8459) LOW-LYING ONE-PHONON STATES OF EVEN-EVEN NUCLEI IN THE REGION 224 LESS THAN OR EQUAL TO A LESS THAN OR EQUAL TO 234. Ivanova, S. P.; Komov, A. L.; Malov, L. A.; Soloviev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Energies and wave functions are calculated for the first one-phonon states in the even-even isotopes of Ra, Th and U. The calculation results agree well with the corresponding experimental data. (6 tables, 2 figures) (SDF)

18668 (ORO-3346-167) LEVELS OF ^{250}Cf POPULATED IN THE DECAY OF ^{250}Bk. Uecke, J. W. (Georgia Inst. of Tech., Atlanta (USA)). Jun 1975. 61p. Dep. NTIS $6.25.

Thesis.

The nuclide ^{250}Bk undergoes beta-decay with a half-life of 3.2 h to 13.1 y ^{250}Cf. A study is undertaken of the excited states in ^{250}Cf populated by ^{250}Bk decay which results from the alpha-decay of 276d ^{254}Es. The general features of published level schemes for these nuclei are consistent with predictions of the Nilsson and collective models; however, there remain many undiscovered transitions and ambiguous or uncertain level assignments. In an attempt to confirm predictions of current theoretical models which account for nuclear level assignments in this nucleus, these gamma transitions and their levels have been studied. Twenty-eight new gamma-rays were determined. The decay of ^{250}Bk is investigated primarily by high resolution gamma-ray singles spectrometry and supported in part by two-parameter gamma-gamma coincidence spectrometry. The equipment, comprised of a Ge(HP) and a large volume Ge(Li) detector, a 4096-channel two-parameter analyzer, and a PDP-8/e computer system, permitted significant improvement in sensitivity and accuracy over previous investigations on this nucleus. (11 figures, 2 tables) (auth)

18669 (RFP-2364) SEARCH FOR ELEMENT 110 IN NATURE. Martin, H. R.; Miller, H. W. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 9 Jul 1975. Contract AT(29-1)-1106. 10p. Dep. NTIS $4.00.

The results of a search for Element 110 in nature are reported. Techniques for estimating the geological concentration and for chemically concentrating noble superheavy elements are described. An upper limit of 10^{-14} to 10^{-15} grams per gram of ore is estimated for the abundance of Element 110, if a half-life of 10^9 years is assumed. (4 figures) (auth)

18670 (UCID-16787) FISSION CROSS SECTION MEASUREMENTS AT THE LLL 100-MeV LINAC. Browne, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 May 1975. Contract W-7405-Eng-48. 10p. Dep. NTIS $4.00.

The fission cross section for ^{235}U was measured from thermal energy to 20 MeV in several steps. First, the cross section was measured from 8 MeV to 20 MeV relative to the n,p scattering cross section and then from thermal to one MeV relative to ^{6}Li(n,alpha). In addition, a measurement of the ratio of the fission cross sections of ^{235}U and ^{238}U relative to ^{235}U has been completed in the range 1 keV to 30 MeV for ^{233}U and 100 keV to 30 MeV for ^{238}U. Statistical uncertainties are less than 4 percent. (SDF)

18671 (WANL-TMI-358) CALCULATION OF RESONANCE INTEGRALS, WITH EMPHASIS ON ^{235}U AND ^{238}U, INCLUDING DOPPLER BROADENING. Drawbaugh, D. W.; McCune, W. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1962. 41p. Dep. NTIS $5.25.

A brief description of the technique used to obtain Doppler broadened resonance parameters in ^{235}U for use in Monte Carlo code calculations is given. Resonance integrals are calculated and compared for the following methods: by the formula used in the MUFT-4 code; results from the MUFT code; results using the REPITITIOUS Monte Carlo-code; and results using the QUERY narrow resonance (NR) and narrow resonance infinite mass (NRIA) methods. For uranium-carbon homogeneous mixtures of ^{235}U and ^{238}U, resonance integrals for various carbon to uranium ratios and at various temperatures can be read from the graphs provided. (8 graphs, 2 tables) (SDF)

18672 (WAPD-TM-1204) ABSORPTION CROSS SECTION MEASUREMENTS FOR ^{252}Cf SPONTANEOUS FISSION NEUTRONS (LWBR DEVELOPMENT PROGRAM). Green, L. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Jun 1975. Contract AT(36-1)-GEN-14. 14p. Dep. NTIS $4.00.

Absolute absorption cross sections have been measured for ^{232}Th and ^{197}Au for ^{252}Cf spontaneous fission neutrons. Irradiations were performed in an exceptionally low mass source-foil arrangement, providing a "pure" spectrum with few corrections. Calibration of the activation detector was achieved by irradiating identical foils in the National Bureau of Standards (NBS) Standard Thermal Flux. A simple ratio technique was also used to obtain an independent estimate of the relative ^{232}Th to ^{197}Au integral cross sections, yielding a value in good agreement with that above. This technique was extended to ^{181}Ta, ^{98}Mo, and ^{63}Cu. (5 tables, 3 figures) (auth)

18673 (WAPD-TM-1217) MONTE CARLO ANALYSIS OF DIRECT MEASUREMENTS OF THE THERMAL ETA (.025 eV)

FOR ^{233}U AND ^{235}U (LWBR DEVELOPMENT PROGRAM). Ullo, J. J.; Goldsmith, M. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Apr 1975. Contract AT(36-1)-GEN-14. 38p. Dep. NTIS $5.00.

Significant inconsistencies have been observed between measured values of eta and of nu, which are related by eta equals nu/(1 + alpha). In support of the LWBR program, manganese bath measurements of eta of ^{233}U and ^{235}U employing monoenergetic 0.025 eV neutrons were analyzed using Monte Carlo methods and ENDF-4 cross sections. The calculated (eta^*/eta_{2200}) ratios are essentially independent of the values assumed for eta_{2200}. The standard deviation on our calculated values of eta includes Monte Carlo, cross section, and experimental uncertainties. The Monte Carlo analysis was confirmed by calculating measured quantities used by the experimentalists in their reduction of eta* to eta. (4 figures, 12 tables) (auth)

18674 (WAPD-TM-1218) MONTE CARLO ANALYSIS OF THERMAL SPECTRUM AVERAGED MEASUREMENTS OF ETA OF U-233 AND U-235 (LWBR DEVELOPMENT PROGRAM). Goldsmith, M.; Ullo, J. J. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Apr 1975. Contract AT(36-1)-GEN-14. 32p. Dep. NTIS $4.75.

Since the number of fission neutrons produced per absorption, eta, is crucial to the performance of light water breeder reactors, a reanalysis of measurements of this parameter was undertaken. In the Mn bath experiments, a beam of thermalized neutrons, defined by Cd difference, was allowed to impinge on various fissionable targets. The ratio of the resulting bath activation to that produced when the target is removed is denoted by eta*. Monte Carlo calculations, employing ENDF-4 cross sections, yielded eta^*/eta_{2200} ratios for ^{233}U and ^{235}U. The Monte Carlo analysis was confirmed by calculating measured quantities used by the experimentalists in their reduction of eta* to eta_{2200}. (3 figures, 5 tables) (auth)

18675 MEASUREMENTS OF THE BETA ENERGY RELEASE RATE AT SHORT TIMES AFTER FISSION IN URANIUM-235. Alam, B.; Scobie, J. (Scottish Universities Research and Reactor Centre, Glasgow). Ann. Nucl. Sci. Eng.; 1: No. 11/12, 573-574 (Nov 1974).

Previous measurements of beta energy release following thermal neutron fission of ^{235}U were extended to shorter times and results are presented for the range 0.2 to 30 secs. The method is briefly described. When the results for 10 and 100 sec irradiations were normalised to previous results at a decay time of 10 sec, the time dependence of the new data was within ±2% of that of the earlier measurements over the range 5 to 30 secs, where they overlapped. Extrapolation of the 100 sec results gave a value of 4.4 ± 0.4 MeV/sec for the beta energy release rate at zero decay time. It was also deduced that the total beta energy release in fission was 7.1 ± 0.5 MeV/fission. (UK).

18676 EVALUATION OF NUCLEAR DATA FOR ^{235}U IN THE NEUTRON ENERGY REGION FROM 10^{-4} TO 1 eV. Kon'shin, V. A.; Davydovskaya, N. U.; Sukhovitskii, E. Sh. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 13-21(1975). (In Russian).

Evaluation of the neutron cross sections σ_α, σ_f and the values α and η for ^{235}U was made in the neutron energy region from 10^{-4} eV to 1 eV. The recommended values for $\sigma_\alpha(E)$, $\sigma_f(E)$, $\alpha(E)$ and $\eta(E)$ were obtained by analyzing the experimental data available. The "best" curves for $\sigma_\alpha(E)$ and $\sigma_f(E)$ were suggested, and the curve of $\eta(E)$ measured directly was compared with $\eta(E)$ derived from σ_α/σ_f and α. (4 figures, 1 table) (auth)

18677 MEASUREMENT OF THE RATIO OF THE EFFECTIVE FISSION CROSS SECTION $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{238}$, $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{239}$ AND HETEROGENEOUS EFFECTS IN FAST-THERMAL CRITICAL ASSEMBLIES. Malykhin, A. P.; Zhuk, I. V.; Yaroshevich, O. I.; Churkin, Yu. I. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 22-24(1975). (In Russian).

The technique and results of precise measurements of the effective fission cross-section ratios $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{238}$ and $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{239}$ in a hard neutron spectrum by solid-state track detectors are described. Solid-state track detectors were used with a pre-etched mica cover of 0.03 mm thickness. Thermal calibration measurements were made in the thermal column of IRT-R reactor. An accuracy better than 1% for $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{238}$ and ~ 1% for $\bar{\sigma}_f^{235}/\bar{\sigma}_f^{239}$ has achieved. The sources of systematic errors are discussed. (auth)

18678 NUCLEAR REACTIONS OF ^{238}U WITH 300- AND 11.5-GeV PROTONS: FORMATION OF NUCLIDES IN THE $A = 110$–140 MASS REGION. Yu, Y.W.; Biswas, S.; Porile, N.T. (Department of Chemistry, Purdue University, Lafayette, Indiana 47907). Phys. Rev. C 11: No. 6, 2111-2113 (June 1975).

Cross sections for the formation of a number of iodine, tellurium, and cadmium nuclides in the interaction of ^{238}U with 300- and 11.5-GeV protons have been determined. Including previously obtained results on cesium and barium nuclides we obtain a weighted average value of 0.92 ± 0.14 for $\sigma_{300}/\sigma_{11.5}$ based on 34 values for nuclides in the $A = 100$–140 region. The cross section ratios show little dependence on $Z_A - Z$. (auth)

18679 SPONTANEOUS FISSION DECAY CONSTANT OF ^{238}Pu. Gay, R. R. Stanford, CA; Univ. of Stanford (1975). 79p. University Microfilms Order No. 75-13,527.

Thesis (Ph. D.).

Due to the high alpha-to-spontaneous fission back ratio of plutonium-238, previous attempts to measure its spontaneous fission rate were limited to few total fissions, with poor statistical accuracy resulting. Two independent techniques are used which have been able to surmount the alpha pile-up problem. In addition, a survey of current advances in the theory of spontaneous fission is presented. The first measurement technique involved the use of the mineral mica as a solid-state fission-track recorder. In one exposure spontaneous fission fragments are recorded. In the second exposure, tracks from thermal fissions in Pu-238 and Pu-239 as well as spontaneous fission are recorded. The spontaneous fission-decay constant may be calculated without knowledge of the source mass and absolute track-registration efficiency. By using the vendor's value of source isotopic ratio and measuring the thermal column flux with gold foils, a value is obtained for the spontaneous fission-decay constant of Pu-238. In terms of half-life, this value is $4.63 \pm 0.12 \times 10^{10}$ years. The second technique involved coincidence counting of fission fragments using silicon surface-barrier semiconductor detectors. The alpha rate of the source was measured by lower geometry alpha counting. The absolute counting efficiencies for both coincidence and alpha counting were calculated by a Monte Carlo computer program. The validity of the Monte Carlo calculation was checked by comparison with alpha counting of a standard alpha source. (Diss. Abstr. Int., B)

Nuclear Theory

Refer also to abstracts 18478, 18550, 18563, 18600, 18602, 18644, and 18667.

18680 (AECL-4839) NUCLEAR CHARGE, CONVECTION CURRENT, AND MAGNETIZATION CURRENT DENSITIES. Lee, H. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1975. 118p. Dep. NTIS (US Sales Only) $9.00. AECL $2.00.

Nuclear electromagnetic charge and current densities and related topics are discussed. Formulas expressing the multipole-decomposed density distributions in terms of the transition density matrix, geometrical factors and single-particle radial wavefunctions are given in detail. These formulas are used for coding a program, MICRØDENS, written in Fortran-IV, to compute the densities. MICRØDENS also computes the form factors, or the Bessel transforms of the densities. Instructions for the use of the program are provided. Three appendices discuss the densities in connection with several physical processes (gamma-emission, electron scattering and photo nucleon-emission), present the formulas for the computation of the transition density matrix in the most commonly used nuclear models, and give a complete listing of MICRØDENS. (3 figures, 4 tables, 28 references) (auth)

18681 (BNL-tr-597) THEORY OF MAGIC NUCLEI. Nosov, V. G.; Kamchatnov, A. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. Translation by S. J. Amoretty of IAE-2286. 50p. Dep. NTIS $5.50.

A consistent theory of the shell and magic oscillations of the masses of spherical nuclei is developed on the basis of the Fermi liquid concept of the energy spectrum of nuclear matter. A "magic" relationship between the system's dimensions and the limiting momentum of the quasi-particle distribution is derived; an integer number of the de Broglie half-waves falls on the nuclear diameter. An expression for the discontinuity in the nucleon binding energy in the vicinity of a magic nucleus is obtained. The role of the residual interaction is analyzed. It is shown that the width of the Fermi-surface diffuseness due to the residual interaction is proportional to the squared vector of the quasi-particle orbital angular momentum. The values of the corresponding proportionality factors (the coupling constant for quasi particles) are determined from the experimental data for 52 magic nuclei. The rapid drop of the residual interaction with increasing nuclear size is demonstrated. (7 figures, 3 tables) (auth)

18682 (EFI-53(74)) MODELING OF π^+-MESON PHOTOPRODUCTION ON NUCLEI. Vartapetyan, G. A.; Vat'yan, A. L.; Muradyan, Eh. G.; Khudaverdyan, A. G. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 12p. (In Russian). INIS.

By the Monte Carlo method an experiment is modeled on the photogeneration of separate π^+-mesons on nuclei in the incoherent region. The purpose of the study was the following: (a) control the correctness of selecting the kinematic conditions for recording separate π^--mesons on a magnetic spectrometer, (b) determining the efficiency of the unit necessary for calculating the differential, effective cross-section of the process by starting from the number of recorded events, (c) estimating the measurement accuracy of the absolute value of the limiting energy of the bremsstrahlung spectrum E_γ and of the average momentum of the spectrometer P_0, (d) calculating the average value of the energy of the incident photon $\bar{E}_\gamma$ and of the 4-dimensional, transmitted momentum $\bar{H}$ for the recorded events. The calculations took into account the form of the bremsstrahlung spectrum, the dimensions of the target, the Fermi momentum distribution of nucleons in the nucleus, the geometry of the magnetic spectrometer with the lens aperture, magnet and dimensions of the detectors being taken into account. In the experiment with the magnetic spectrometer, measurements were made of the number of π-mesons passing through the spectrometer as a function of the momentum of the π-meson P_π. The experimental data are in agreement at $E_\gamma = 2.95$ GeV with the corresponding, calculated Monte Carlo curve. In the case of $E_\gamma = 3.1$ GeV at small values of P_π the experimental points lie above the calculated curve. This behavior indicates that in this region of momenta there is a contribution from reaction of the type $\gamma N \rightarrow \pi^+\pi^0 N$ and $\gamma N \rightarrow \pi^+\Delta$. (SJR)

18683 (ISS-P-74/5) EFFECTS OF THE REPULSIVE CORE OF NUCLEAR FORCE IN ELASTIC AND QUASI-ELASTIC SCATTERING OF ELECTRONS AND HADRONS BY NUCLEI. Ciofi degli Atti, C. (Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica). 10 Jun 1974. 44p. (CONF-740592-1). Dep. NTIS (US Sales Only) $5.25.

From symposium on measurement and interpretation of strong pulses in nuclei; Saclay, France (8 May 1974).

Some problems in the high momentum interpretation of elastic and quasi elastic scattering of electrons and hadrons by light nuclei are discussed, with particular emphasis on the effects of the repulsive core estimated within the framework of Brueckner's and Jastrow's approaches. (11 figs., 1 table, 37 ref.) (auth)

18684 (ITP-74-97P) ELECTRIC PROPERTIES OF EVEN NUCLEI. Ovcharenko, V. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 29p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A brief semi-classical description of the processes of Coulomb excitation, in particular the reorientation effect, is presented. The results of applying the theory of electric quadrupole moments of the first 2^+ states, developed by Davydov and the author, to a great number of even nuclei are discussed. (1 table, 2 figures) (auth)

18685 (JINR-E4-8558) FRAGMENTATION OF SINGLE-PARTICLE STATES IN DEFORMED NUCLEI. Malov, L. A.; Soloviev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

The fragmentation of single-particle states is studied in the framework of the model based on the account of quasiparticle-phonon interaction by the example of ^{239}U and ^{169}Er nuclei. The dependence of fragmentation on the position of the single-particle level with respect to the Fermi surface is investigated. It is shown that in the distribution of the single-particle strength in addition to a large asymmetric maximum, there appears at high excitation energies a second maximum, and the distribution itself has a long tail. A fundamentally new semi-microscopic method of calculating the neutron strength functions which is based on single-particle fragmentation is suggested. In the case of ^{169}Er it is shown that if the $4S_{\frac{1}{2}}$ subshell contribution is excluded from the single-particle wave functions then the calculated S-wave strength function decreases by a factor of 20 and corresponds to the value of the strength function in the range of its minimum. (1 table, 3 figures) (auth)

18686 (JINR-E4-8692) GENERATOR COORDINATE METHOD AND DERIVATION OF THE COLLECTIVE HAMILTONIAN. Janssen, D.; Jolos, R. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

An approximate method is developed for the calculations of the quadrupole fermion operators matrix elements between the collective states with arbitrary number of quasiparticles. The method is used for the construction of the collective Hamiltonian. The connection is shown between this method and the generator coordinate one. (1 figure) (auth)

18687 (JINR-E4-8732) DEVELOPMENT OF A MODEL FOR THE DESCRIPTION OF HIGHLY EXCITED STATES IN ODD-A DEFORMED NUCLEI. Malov, L. A.; Solov'ev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 9p. Dep. NTIS (US Sales Only) $4.00.

An approximate method is suggested to solve the system of equations, developed earlier for the description of the structure of intermediate and highly excited states in the framework of the model, based on the account of quasiparticle-phonon interaction. The new method has the advantage as compared with the approximate methods of solving the latter system of equations developed earlier. Consideration is made for the case of odd-A deformed nuclei when several one-quasiparticle components are taken into account. (auth)

18688 (JINR-P4-8536) MATRIX ELEMENTS OF MULTIPOLE OPERATORS BETWEEN ROTATIONAL STATES OF ODD-MASS NUCLEI. Karadjov, D. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A general formula for the reduced matrix element of an arbitrary multipole operator, acting between rotational states of an odd-A nucleus, is obtained in the framework of the Intrinsic-Excitation Coupled-to-Rotator Model (IECRM). The influence of the overlap integrals on the value of the E2-transition probabilities is demonstrated in the case of electric transitions in ^{235}U nuclei. (auth)

18689 (JINR-P4-8582) NONROTATIONAL STATES OF ODD-MASS NUCLEI IN THE REGION 225 LESS THAN OR EQUAL TO A LESS THAN OR EQUAL TO 233. Ivanova, S. P.; Komov, A. L.; Malov, L. A.; Solov'ev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Within the semimicroscopic approach of the Saxon-Woods potential, the energy and the structure of low-lying (up to about 1 MeV) nonrotational states of the odd-mass nuclei in the region $225 \leq A \leq 233$ were calculated. The results of calculations agree well with corresponding experimental data. (9 tables) (auth)

18690 (JINR-P4-8687) INFLUENCE OF LOW-FREQUENCY VIBRATIONS ON THE TIME OF KEEPING OF ULTRACOLD NEUTRONS IN A TRAP. Connection with a Low-Temperature Anomaly of a Specific Heat of Disordered Solid Bodies. Ignatovich, V. K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The influence of low-frequency part of a solid body spectrum on heating of ultracold neutrons (UCN) at a single collision with the wall has been considered. It is shown that in the presence of clusters (vibrating with a frequency of 10^{10} Hz) in a solid body near the surface the anomalously small lifetime in traps can be explained by the ultracold neutron heating. Comparison with the results of experiments on measurement of a specific heat of disordered solid bodies at low temperature leads to the conclusion that the cluster dimensions must be near 70-60 Å. The influence of other possible low-frequency vibrations inside a solid body on the ultracold neutron heating has been considered. (auth)

18691 (JINR-P4-8729) FORMALISM FOR THE DESCRIPTION OF MANY-PARTICLE UNDERBARRIER QUASISTATIONARY STATES. Kadmenskii, S. G.; Furman, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The formalism for the description of the many particle underbarrier quasistationary levels is considered. The method is based on the introduction of the physical resonance states in the R-matrix basic states. The integral formula for the partial decay widths is obtained. (auth)

18692 (JINR-P4-8730) CLUSTER ASPECTS OF α-DECAY. Kadmenskii, S. G.; Furman, V. I.; Kholan, S.; Khlebostroev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 30p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

On the basis of the non-R-Matrix approach to the α decay theory the surface α-cluster model of α decay is introduced. In the frame of this model evidence is obtained about an important contribution of the peripheral region of parent nuclei for the absolute α decay widths. A classification of the α transitions following the values of experimental probabilities for the existence of α particles at the nuclear surface is performed. (1 table, 3 figures) (auth)

18693 (JINR-P4-8731) NEW METHOD FOR CONSIDERING THE FINITE RANGE INTERACTION IN THE DIRECT CLUSTER AND TWO-NUCLEON TRANSFER REACTIONS. Lomachenkov, I. A.; Furman, V. I.; Kholan, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Using a new method for separation of variables it is shown that standard cluster transfer reaction is invariant with respect to the choice of integration variables. The cross section of the two-nucleon transfer reaction A(t,p)B is expressed in terms of the standard partial amplitude in close analogy with the case of the one-particle transfer. New formulae for the calculation of the radial integrals with the finite range interaction have been obtained. (2 figures) (auth)

18694 (JINR-P4-8755) FORMULATION OF A MODEL FOR DESCRIPTION OF NONADIABATIC EFFECTS IN DEFORMED NUCLEI AT MODERATELY FAST ROTATION. Piperova, J. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A model is formulated for description of the changes of collective parameters in rotating even-even deformed nuclei. (auth)

18695 (JINR-P4-8777) CALCULATION OF DISTRIBUTION OF SINGLE-PARTICLE STATE FORCES. Ochirbat, G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The method of Green's function was applied to calculate the distribution of single-particle states among actual nuclear levels. A chain of equations for these functions was obtained in a model of interacting phonons and quasi particles. Neglecting the higher-order Green's function and thus cutting the chain of equations corresponds to neglecting the higher-order components of the wave function in the variational methods. The one- and two-phonon approximations are discussed, and the convenience of the Green's function method for this case is demonstrated. (auth)

18696 (LA-5929-MS) FITPI: MODIFICATIONS TO THE OPTICAL MODEL PROGRAM PIRK FOR PARAMETER SEARCHES AND TOTAL CROSS SECTIONS. Cooper, M. D.; Eisenstein, R. A. (Los Alamos Scientific Lab., N. Mex. (USA)). Mar 1975. Contract W-7405-eng-36. 13p. Dep. NTIS $4.00.

The pion-nucleus optical code PIRK has been modified to allow for searches on the optical potential parameters and nuclear density and charge parameters. The code can simultaneously fit both to positive and negative pion elastic scattering angular distributions as well as total cross sections, total reaction cross sections, and total elastic cross sections. The operation of the code has been changed to separate more fully Coulomb from nuclear effects, hence allowing for the calculation of total cross sections. (1 figure, 2 tables) (auth)

18697 (LA-6002) POTENTIAL WELL SHAPES FOR TENSOR TERMS INVOLVING SPIN. Keaton, P. W. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-ENG-36. 6p. Dep. NTIS $4.00.

Potential well shapes for spin-orbit interactions are predicted using heuristic arguments. The results are generalized to interactions of the second rank in spin. Comparison with well known potential interactions are in agreement with the conclusions. (1 table, 1 figure) (auth)

18698 (LBL-3495) NEW ASPECTS OF HIGH ENERGY HEAVY-ION TRANSFER REACTIONS. Scott, D. K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 36p. (CONF-750341-1). Dep. NTIS $5.00.

From international conference on cluster structure of nuclei and transfer reactions induced by heavy ions; Tokyo, Japan (17 Mar 1975).

New aspects of heavy ion reactions at incident energies in the region of 10 MeV/nucleon are discussed with an emphasis on the peripheral nature of the collisions, which leads to simplicities in the differential cross sections. The distortion of the peripheral distribution through the interference of direct and multistep processes is used to illustrate aspects of high energy reactions unique to heavy ions. The simplicities of the distributions for reactions on lighter nuclei are exploited to give new information about nuclear structure from direct and compound reactions at high energy. (16 figures, 32 references) (SDF)

18699 (ORO-2434-11) EXPERIMENTAL STUDY OF NUCLEAR MODELS. I. Decay Schemes and Nuclear Reactions. II. Muonic X-Ray Studies. Progress Report, October 1, 1974–September 30, 1975 Sheline, R. K. (Florida State Univ., Tallahassee (USA)). 1975. Contract AT(40-1)-2434. 54p. Dep. NTIS $5.50.

Progress on the research on our AT-(40-1)-2434 Contract is summarized for the twelve month contract year beginning October 1, 1974, and ending September 30, 1975. The main emphasis of our research continues to be an experimental study of nuclear models. Some change of emphasis is occurring. In the past, the emphasis has been overwhelmingly nuclear reaction spectroscopy and comparison with theoretical models. This year an increasing percentage of the emphasis (perhaps 25 percent) is on the study of nuclear structure from the view point of muonic x-ray spectroscopy. A list of publications is included. (JFP)

18700 (ORO-4856-9) NON-COUPLED INTEGRAL EQUATIONS FOR THE PHYSICAL THREE-PARTICLE AMPLITUDES. Technical Report No. 75-083. Bolle, D. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). May 1975. 12p. Dep. NTIS $4.00.

Starting from the Karlsson-Zeiger and the Osborn-Kowalski equations, several sets of non-coupled integral equations for the physical three-particle amplitudes are derived. These sets are obtained from the Alt-Grassberger-Sandhas equations. The specific properties and advantages of these non-coupled equations are discussed. (auth)

18701 (RL-75-029) COMPUTER PROGRAMS USED IN THE UK FOR THE ANALYSIS OF NEUTRON SCATTERING DATA. Stirling, G. C. (comp.). (Science Research Council, Chilton (UK). Rutherford Lab.). Feb 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

Short descriptions of computer programs are listed under the following headings: triple axis spectrometry (seven programs); inelastic time-of-flight spectrometry (thirteen programs); single crystal diffractometry (six programs); powder, liquids and diffuse scattering (seven programs). (UK)

18702 (ZFK-274) SHELL CORRECTION METHOD AND ITS APPLICATIONS. Frauendorf, S. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1974. 45p. Dep. NTIS (US Sales Only) $5.25.

The main features of the shell correction method for the calculation of deformation energy are presented. In this connection a generalization of the shell concept is introduced which is based on the deviations of the single-particle level density from its mean value. The origin of these fluctuations of the level density is discussed by means of a simple model. The application of the shell correction method for investigation of nuclear fission is presented in some detail. Special attention is paid to the double-humped fission barrier. A method based on the shell correction idea is presented which allows calculation of the lifetimes with respect to spontaneous fission. (27 figures, 2 tables) (auth)

18703 CONNECTION BETWEEN THE DECAY PROBABILITIES OF TWO-PHONON STATES AND QUADRUPOLE MOMENTS OF PHONONS IN ATOMIC NUCLEI. Troitskii, M. A.; Khodel, V. A. JETP Lett. (USSR) (Engl. Transl.); 20: No. 7, 237-238 (5 Oct 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red; 20: No. 7, 520-523(5 Oct 1974).

The connection between the quadrupole moments of the single-phonon states and the probabilities of two-phonon annihilation is analyzed. A decrease of the latter with the former is found, in agreement with experiment. (auth)

18704 QUASIPARTICLE-PHONON COUPLING IN THE ODD-A Te ISOTOPES. Sen, S. (Saha Inst. of Nuclear Physics, Calcutta). J. Phys., G. (London); 1: No. 3, 286-302(1 Apr 1975).

The odd-A Te isotopes, ^{123}Te, ^{125}Te and ^{127}Te are studied in a version of the unified vibrational model which incorporates both pairing effects and anharmonicity in the core vibrations. The neutron quasiparticle states in the N = 50 to 82 shell are coupled to anharmonic vibrations of the corresponding even cores. The calculated results are discussed in the light of the recent experimental findings. (auth)

18705 APPROXIMATE E2 RELATIONS FOR EVEN–EVEN NUCLEI FROM COLLECTIVE MODEL SUM RULES. Naqib, I. M. (Univ. of Liverpool). J. Phys., G. (London); 1: No. 3, L19-L22(1 Apr 1975).

From collective model sum rules derived from the various possible intermediate couplings of a zero-coupled product of four E2 operators, approximate expressions are obtained for the reduced transition probability $B(E2, 4^+ \rightarrow 2^+)$ and the magnitude of the static quadrupole moment $|Q_{2^+}|$ of the first 2^+ state for an even–even nucleus in terms of other E2 transition strengths. (auth)

18706 ROTATIONAL-SINGLEPARTICLE, EXCITED STATES OF NONAXIAL, ODD ATOMIC NUCLEI OF THE SD-SHELL. Israilov, A. A.; Sharipov, Sh. (Inst. of Nuclear Physics, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 11, 27-29(1974). (In Russian).

A nuclear model is used that consists of a nuclear core and a single external nucleon. The total angular momentum of the external nucleon is not conserved. The hamiltonian of the model, without taking into account surface oscillation of the nuclear core, consists of an operator for the rotational energy of the core, and of operators for the spherical and nonspherical parts of the interaction of the external nucleon with the core. Parameters are defined for deformation and nonaxiality of the core shape as β and γ respectively. Calculations of the energy of rotational-singleparticle states are carried out as a function of γ for a number of values of β. Calculated data are compared with experimental data for ^{29}Al. (1 table, 1 figure) (SJR)

18707 CORRECTION FACTORS OF AN ACCURACY OF ONE THOUSANDTH FOR RADIOACTIVE DECAY AND SATURATION. Bereznai, T. (Budapest Muszaki Egyetem Tanreaktora); Pernecki, G.; Keomley, G. Izotoptechnika; 18: No. 2, 65-114(Feb 1975). (In Hungarian).

The use of tables in problems of radioactive saturation and decay is usually accompanied by problems of a practical nature in the correction factors. In an effort to alleviate these, a table is given in which the values of correction factors belonging to arbitrary values of t/T and τ/T can be determined with an accuracy of 0.001. (RWR)

18708 EFFECT OF THE IMPULSE MOMENT ON THE STRUCTURE OF He NUCLEUS. Bohr, A.; Mottelson, B. R. (Niels Bohr Institutet, Copenhagen). Fys. Tidsskr.; 72: No. 2-3, 58-73 (1974). (In Danish).

Nuclear physical phenomena hitherto considered have been capable of representation on a three-dimensional model representing proton and neutron numbers, and energy of excitation. It is now desirable to add a fourth dimension corresponding to the high values of the impulse moment which can be applied, and which have a decisive effect on the structure. This arises particularly from the use of accelerators. The topic is discussed under the headings: stability limits; (the rotating liquid drop, cross section for the formation of compound nuclei); the Yrast spectrum (shell structure, the superfluid phase, transition to normal phase, the different phases along the yrast line). (auth)

18709 EXISTENCE OF NUCLEI HAVING A LARGE EXCESS OF NEUTRONS. Baz, A. I.; Gol'danskii, V. I.; Gol'dberg, V. Z.; Zel'dovich, Ya. B. pp 144-169 of Legkie i Promezhutochnye yadra vblizi granits nuklonnoi stabil'nosti. Moscow; Izdatel'stvo Nauka (1972). (In Russian).

Analysis shows that the probability for the existence of nuclei loaded with excess neutrons is great. Ordinarily any forecasting of the properties of nuclei containing a large excess of neutrons is accomplished by extrapolating the properties of nuclei arranged on or near the beta stability line. Concrete methods of extrapolation may differ from each other. Detailed consideration is given to one approach to this problem which is the most coherent. Attempts are made to calculate directly the binding energy of the nucleus (AZN) through nucleon–nucleon potentials. The single assumption made in this case is the hypothesis that the interaction between nucleons in nuclei can be described by a paired, static potential. (SJR)

18710 WHAT DO WE KNOW ABOUT NUCLEAR FISSION? Aumann, D. C. (Technische Univ., Munich). Angew. Chem. Int. Ed. Engl.; 14: No. 3, 117-136(Mar 1975).

Nuclear fission, although a physical phenomenon, is also of interest to the chemist. It was discovered by chemists, and chemists have made a material contribution to present knowledge in this field. A comprehensive theory of nuclear fission has not, as yet, been developed, despite the volume of experimental data that has been amassed in the 35 years since its discovery. In the past few years discoveries have been made which cannot be explained with conventional theoretical models of nuclear fission. The most important discovery was that of shape isomerism, a novel type of nuclear isomerism. It would appear that an accurate calculation of fission barriers is a prerequisite for precise explanation of many experimental findings. Recent results in this connection and an outline of the present state of knowledge of nuclear fission constitute the main theme of this paper. (18 figures, 1 table, 110 references) (auth)

18711 QUANTUM KINETIC EQUATION FOR FINITE NUCLEUS AND PREEQUILIBRIUM EMISSION. Rumyantsev, B. A.; Kheifets, S. A. (Inst. of Nuclear Physics, Novosibirsk, USSR). Yadern. Fiz.; 21: No. 3, 510-519(Mar 1975). (In Russian).

Quantum kinetic equation describing relaxation to the statistically equilibrium state in a finite Fermi system is obtained by means of the Bogolyubov method of correlation functions. The effect of various terms in the equation and its applicability is analyzed using model problems. The self-consistency effects are taken into account besides the shock relaxation, enabling one to investigate the coherent pre-equilibrium emission and the damping of the collective nuclear states. (auth)

18712 APPROXIMATE SOLUTION OF EQUATIONS OF A MODEL FOR DESCRIBING FRAGMENTATION IN DEFORMED NUCLEI. Malov, L. A.; Solov'ev, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 3, 502-507(Mar 1975). (In Russian).

A new approximate method is developed for solving the basic equations of the model suggested earlier for the description of intermediate and high excitation states of deformed nuclei. As a result of accounting for the pole noncoherent terms, the superfluous roots were excluded, and the accuracy of the approximate solution was improved. Comparison of the exact and approximate solutions for a simple example shows that the approximate solution gives correct values for large components of the wave functions. The proposed method allows one to study the fragmentation of one- and many-particle states in many nonrotational levels in odd-A deformed nuclei. (auth)

18713 PHENOMENOLOGICAL DESCRIPTION OF ENERGY DEPENDENCE OF THE LEVEL DENSITY PARAMETER. Ignatyuk, A. V.; Smirenkin, G. N.; Tishin, A. S. Yadern. Fiz.; 21: No. 3, 485-490(Mar 1975). (In Russian).

The relation is considered between the shell correction to the mass formula and the level density parameter a, determined from the density of neutron resonances. On this basis a phenomenological relation is obtained describing the behavior of the parameter a(Z, N, U) in a wide interval of the nuclear excitation energy. (auth)

18714 OPTICAL-MODEL AND COUPLED-CHANNELS CALCULATIONS IN QUANTUM-MECHANICAL SCATTERING. Doyle, S.D.; Eck, J.S.; Thompson, W.J.; Weaver, O.L. (Department of Physics, Kansas State University, Manhattan, Kansas 66506). Am. J. Phys. 43: No. 8, 677-682 (Aug 1975).

Non-Hermitian Hamiltonians are used in many research areas as approximate models of physical systems, for example, the optical-model potential in nuclear physics. Such Hamiltonians are rarely treated in introductory quantum mechanics. Here the quantum scattering problem of a two-state system is treated exactly for the case of one-dimensional square-well potentials. By introducing an appropriate optical-model potential, an approximate solution for one of the two states is obtained. The exact and approximate solutions are compared for a realistic example. (auth)

18715 STRUCTURE OF DEVELOPED PION CONDENSATE. Sorokin, G.A. (L. D. Landau Institute of Theoretical Physics, USSR Academy of Sciences). JETP Lett. 21: No. 5, 143-144 (5 Mar 1975).

A phase transition leading to a change in the structure of the pion condensate in nuclear matter is considered. (auth)

18716 CORRELATION AND CORE POLARIZATION IN TIME-DEPENDENT HARTREE-FOCK THEORY. Jamieson, M. J. (Glasgow Univ.). J. Phys., B (London); 8: No. 4, 537-545(11 Mar 1975).

The time-dependent Hartree-Fock (TDHF) perturbation equations are written in a form similar to the random phase approximation and solved to first order in electron-electron interaction to demonstrate that TDHF theory yields polarizabilities and matrix elements correct to first order in correlation. It is shown for alkali atoms and two-electron ions that the contribution of correlation to the dipole matrix element may be attributed to polarization of the core electrons. The TDHF expression for the transition matrix element connecting the $1s^2\ ^1S$ and $1snp\ ^1P$ states of a two-electron ion is shown to be identical with the Z-expansion expression of Dalgarno and Parkinson within the first-order correlation. A numerical comparison is given of the correction invoked by correlation to the Hartree-Fock matrix element and that given by TDHF theory. (auth)

18717 A DOPPLER-SHIFT ATTENUATION WITH A SINGLE CRYSTAL TARGET. Ogino, K. (Kyoto Univ. (Japan). Faculty of Engineering); Mannami, M. Bull. Inst. Chem. Res., Kyoto Univ.; 52: No. 1, 8-11(Jul 1974).

It is proposed that short lifetimes around 10^{-16} second in γ-ray emitting nuclear reaction can be measured by Doppler-shift attenuation method using a single crystal target. (auth)

18718 PRE-EQUILIBRIUM AND HEAT CONDUCTION IN NUCLEAR MATTER. Weiner, R.; Weström, M. (Fachbereich Physik, Philipps-Universität, Marburg/Lahn, West Germany). Phys. Rev. Lett. 34: No. 24, 1523-1527 (16 June 1975).

A model for pre-equilibrium nucleon emission is formulated in terms of diffusion of heat in nuclear matter. A strong asymmetry in the angular distribution of evaporation products is predicted. (auth)

18719 RELATION BETWEEN THE ENERGY-WEIGHTED SUM RULES FOR NUCLEAR PHOTOABSORPTION AND NUCLEAR MUON CAPTURE. Goulard, B. (Laboratoire de Physique Nucléaire, Université de Montréal, Montréal, Canada); Primakoff, H. Phys. Rev. C 11: No. 6, 1894-1898 (June 1975).

A relation between the energy-weighted sum rules for nuclear photoabsorption and nuclear muon capture is derived and is used to show that, at least in the case of nuclei with $Z = A - Z$, the mean energy of the neutrinos emitted in muon capture does not vary appreciably as A and Z vary. The Foldy-Walecka expression for the total muon-capture rate is rederived on the basis of the energy-weighted sum rule and is used to show that, at least in the case of nuclei with $Z = A - Z$, and apart from the difference in ground-state energy between the nuclei $[Z-1, A = 2Z]$ and $[Z, A = 2Z]$, the mean energy of excitation of $[Z-1, A = 2Z]$ due to muon capture is essentially equal to the energy of the giant dipole resonance in $[Z, A=2Z]$. (auth)

18720 FOUR-BODY FORCES IN NUCLEAR MATTER. Blatt, D.W.E. (Department of Theoretical Physics, University of Sydney, Sydney, New South Wales 2006, Australia and School of Computing Science, New South Wales Institute of Technology, Syndey, New South

Wales 2007, Australia); McKellar, B.H.J. Phys. Rev. C 11: No. 6, 2040-2048 (June 1975).

The binding energy contributions to nuclear matter from four-body forces have been estimated. The four nucleon potential is written in coordinate space, and two intermediate nucleons are treated as spectators to give an effective two-body potential. Two-body correlations are included between all four nucleons and, following a coordinate transformation, two of the six dimensions for the spectator nucleons can be integrated analytically. Spin-isospin dependence is extracted and the remaining integrations are done numerically to give a one-pion-exchange-potential–like effective potential similar to the three-body force effective potentials of Loiseau, Nogami, and Ross. Binding energy calculations can then be done in the usual manner. As the number of nucleons increases the effect of exchanges of the spectator nucleons must also be considered. When this is taken into account, the over-all contribution to the energy of nuclear matter approximately 0.1 MeV attraction. (auth)

18721 PREDICTIONS OF THE MASSES OF HIGHLY NEUTRON-RICH LIGHT NUCLEI. Jelley, N.A.; Cerny, J.; Stahel, D.P.; Wilcox, K.H. (Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). Phys. Rev. C 11: No. 6, 2049-2055 (June 1975).

A simple mass equation is derived and is shown to provide a good description of the masses of the recently measured $T_z = 5/2$ nuclei in the *s-d* shell. A comparison is made with the method of Garvey *et al.* and predictions of masses and of the stability of neutron-excess light nuclei are given for both methods. (auth)

18722 VARIATIONS OF NUCLEAR POTENTIAL RADII IN ISOTOPIC AND ISOTONIC SEQUENCES. Sood, P.C.; Agrawal, D.C. (Nuclear Physics Section, Department of Physics, Banaras Hindu University, Varanasi-221005, India). Phys. Rev. C 11: No. 6, 2056-2062 (June 1975).

The variations of nuclear potential radii, obtained by fitting the last particle binding energies, are investigated for nuclei in the isotopic and the isotonic sequences. It is found that while the neutron (proton) potential radii increase as $A^{1/3}$ for nuclei in isotonic (isotopic) sequences in accordance with the universally adopted procedure in shell model and optical model studies, these radii do not show the expected behavior in the case of nuclei in isotopic (isotonic) sequences. Possible interrelationship between the variations of the potential radii and those of the nucleon separation energies and also between the potential radii and the density distribution radii in such sequences is investigated. The anomalous variations of the neutron protential radii in the isotopic sequences are found to be related with the fact that the charge distribution radii in such sequences do not increase as rapidly as $A^{1/3}$. The consequences of and the possible physical explanations for such a behavior are discussed. (auth)

18723 ISOSPIN SPLITTING OF THE GIANT RESONANCE. I. ISODOUBLETS. Leonardi, R. (Nuclear Physics Laboratory, Oxford University, England); Lipparini, E. Phys. Rev. C 11: No. 6, 2073-2081 (June 1975).

We study the isospin splitting of the giant resonance of $T = 1/2$ nuclei with sum rules. The particular isospin geometry involved in this case permits a number of simplifications in the isospin sum rules and several largely model independent relations are obtained and discussed. It turns out that for serveral light isodoublets the "symmetry" energy U tends to be smaller than $60(T+1)\ A^{-1}$ MeV. (auth)

18724 KINEMATIC PERTURBATION IN THE THREE-BODY PROBLEM. Avishai, Y. (Ben-Gurion University of the Negev, Beer-Sheva, Israel). Phys. Rev. C 11: No. 6, 2082-2084 (June 1975).

The mixed derivatives that appear in the three-body Schrödinger equation (when written in terms of interparticle distances) are treated as a perturbation. The following results are obtained: (a) $B_3 \geq 3B_2$, where B_n is the n body binding energy. (b) For the harmonic oscillator potential, the calculated binding energy falls with 3% of the exact one. Numerical results for attractive square well and exponential potentials are presented. (auth)

18725 OFF-SHELL UNITARITY CONSTRAINTS AND THE *K*-MATRIX FORMALISM. Kowalski, K.L. (Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106). Phys. Rev. C 11: No. 6, 2094-2098 (June 1975).

The recent results of Kouri and Levin on the properties of the single-channel two-particle off-shell transition amplitude which follow from off-shell unitarity are shown to be readily obtainable from results in the published literature. It is also pointed out that the use of the damping (or Heitler) equation as a realization of off-shell unitarity leads to no new information except on the off-shell structure of the *K*-matrix amplitude. Finally, the implications of off-shell unitarity in some (two-particle) multichannel situations are deduced, thereby extending the results of previous investigations. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 17185, 17402, 17542, 18005, 18284, 18286, 18287, 18289, 18316, 18338, 18504, and 18749.

18726 (CEA-R-4615) APPLICATION OF THE MONTE-CARLO METHOD TO THE SIMULATION OF ELECTRON TRAJECTORIES IN THICK TARGETS IN THE RANGE 10 TO 30 KeV. Henoc, J.; Maurice, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Section de Recherches de Metallurgie Physique). Feb 1975. 183p. (In French). Dep. NTIS (US Sales Only) $12.25.

Microprobe analysis requires the knowledge of the distribution in depth of characteristic x-ray emission. This distribution which is rather difficult to determine by means of experiments may be obtained through the simulation of electron trajectories by the Monte-Carlo method. In this paper we aim to describe a more realistic approach than that commonly used, by replacing the concept of mean energy losses by the statistical treatment of energy losses according to Landau. The results of the two models are compared with the experimental evidence. (auth)

18727 (CONF-750703-12) FLECTRON INTERACTION CROSS SFCTIONS IN Al AND Al_2O_3; CALCULATIONS OF MEAN FREE PATHS, STOPPING POWERS, AND ELECTRON SLOWING-DOWN SPECTRA. Ashley, J. C.; Tung, C. J.; Ritchie, R. H. (Oak Ridge National Lab., Tenn. (USA)). 1975. 17p. Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

An area of concern in the study of slowing-down spectra and interaction cross sections has been the lack of adequate theoretical information on electron interaction probabilities in solids, particularly in the electron energy region below a few keV. By using previously developed models, new calculations of cross sections for ionization by electrons of inner shells in Al and O atoms and a model insulator theory used to describe the valence band in Al_2O_3 are discussed. These new calculations are combined with earlier work to provide an improved description of electron interactions in Al metal and in the insulator Al_2O_3. Some examples of mean free path, stopping power, and electron slowing-down flux calculations for these materials are described. (7 figures) (RWR)

18728 (EUR-5286e) ANGULAR FLUX OF GAMMA RAYS IN A NORMAL CONCRETE SHIELD. Penkuhn, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The angular dependence of the photon energy and dose rate flux in an ordinary concrete slab shield is fitted near the shield axis by a power of the directional cosine $\omega = \cos \varphi$. The exponents found are strongly space-dependent. For large φ, further fits are given. The source energy range from 0.7 MeV to 6 MeV and penetrations of 12.5 cm $\leq x \leq$ 200 cm are considered. (auth)

18729 (JAERI-5030, pp 1-6) NUMBER TRANSMISSION OF 0.6 AND 0.8 MeV ELECTRONS IN ELEMENTAL MATERIALS. Harami, T. (Kyoto Univ.); Takagaki, T.; Matsuda, K.; Nakai, Y. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973-March 31, 1974.

The number transmissions of electrons in Be, Al, Cu and Ag were obtained experimentally for well collimated electron beams of 0.6 and 0.8 MeV. Experimental results of the present work join smoothly to the previous ones of 1.0 MeV to 2.0 MeV electrons. The ratios of extrapolated range R_{ex} to true range R_0 give generally minimum values near 1 MeV ($\sim 2mc^2$) as well as the stopping power. An investigation was done for the empirical equation of the form $\eta = \exp(-x^p/CE^m)$, where E is the incident electron energy, x, penetration depth, and p, C and m are the parameters determined from experimental data. (auth)

18730 (JAERI-5030, pp 7-10) ENERGY DISSIPATION OF 0.6 AND 0.8 MeV ELECTRONS IN ELEMENTAL MATERIALS. Takagaki, T.; Matsuda, K.; Harami, T.; Nakai, Y. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973-March 31, 1974.

The spatial distributions of energy dissipation of electrons in Be, Al, Cu and Ag were obtained experimentally for well collimated electron beams of 0.6 and 0.8 MeV. Experimental results of the present work extend the previous ones of 1.0 MeV to 2.0 MeV electrons. Comparing with Spencer theory, it is found that our experiment and theory are generally in agreement except in shallow penetration depth. The extrapolated range values of the present work extend the atomic number curves of previous work. (auth)

18731 (JAERI-5030, pp 11-15) ELECTRON BEAM DOSIMETRY BY THE (γ,γ') REACTION OF INDIUM AND SILVER. I. Detection of Excitation Spectra and Investigation of Its Applicability to Electron Beam Dosimetry. Matsuda, K.; Harami, T.; Takagaki, T.; Nakai, Y. Mar 1975. (In Japanese).

In fundamental studies in Osaka Laboratory for Radiation Chemistry. Annual report, April 1, 1973-March 31, 1974.

Applicability of the (γ,γ') reaction of ^{115}In and ^{107}Ag, ^{109}Ag to high dose rate electron beam dosimetry was investigated. From the shape of its excitation curves, ^{115}In was a desirable element in the energy region higher than 1.078 MeV. Indium dosimetry seems to be very useful for measurement of high dose rate over 10^6 rads/sec, because it has no upper limit for measurable dose rate. In the energy region lower than 1.078 MeV, the excitation thresholds of ^{107}Ag and ^{109}Ag were found to be about 0.6 MeV. Because their excitation cross sections were very small, we could not examine the dose rate characteristics in the present step. (auth)

18732 (UCRL-76776) MONTE CARLO PROBLEM AND PARALLEL COMPUTERS, AND HOW TO DO A FAST PARTICLE MOVER ON THE STAR 100. Sinz, K. H. P. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Jun 1975. 26p. (CONF-750606-3). Dep. NTIS $4.50.

From 7th conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

Particle simulation problems of the Monte Carlo type are widely believed to be intrinsically highly scalar problems. In the absence of a definitive mathematical theorem to the contrary, this belief is based on the very apparent programming difficulties encountered on a vector machine. This class of problem is therefore thought to be ill-suited to highly parallel and vectorized computers. However, it is demonstrated by several examples that a particle mover is fully vectorizable. In the case of the CDC STAR 100 it is found that the performance of such a particle mover is not hopeless but hopeful, and is in fact helpful. One of the several possible vectorizations is estimated to yield a gain of a factor of 15 on the STAR over good serial coding on the same machine. This falls far short of the STAR's peak vector performance of 30 to 70 times scalar rates because certain fast vector instructions are not available and have to be simulated. The current STAR algorithm outperforms the carefully handcoded 7600 by a factor of 3. This performance margin is achievable despite the 7600's fivefold superior scalar capability. A more generally vectorized particle mover will always substantially outperform scalar coding on any machine equipped with a properly chosen set of fast vector instructions. (auth)

18733 CHARACTERISTIC ENERGY LOSSES OF INJECTED LOW ENERGY ELECTRONS IN IONIC SOLIDS. Huang, T.; Hamill, W. H. (Notre Dame Univ., IN). J. Phys. Chem. Solids; 36: No. 7/8, 661-666(Jul 1975).

Characteristic energy losses of 0 to 18 V electrons have been measured for thin films of alkali and alkaline earth fluorides as well as NaBr, RbBr and RbCl. In addition to losses in the optical region there are also several losses at lower energy for each system, some of which may be due to triplet exciton states. Results for the fluorides, in particular, can be correlated with each other and with optical data. (auth)

18734 INDUCED RADIOACTIVITY LEVEL IN THE AIR UNDER THE INFLUENCE OF HIGH ENERGY BREMSSTRAHLUNG RADIATION. Mil'shtein, R. S.; Tarov, K. G. (Moscow Scientific Research Roentgen Inst.). Med. Radiol.; No. 11, 49-53(1974). (In Russian).

A method was described for determining the level of induced radioactivity in the air, steam, and aerosol, under the effect of high energy bremsstrahlung radiation. The following values of specific induced activity for procedure rooms with air space of 120 cubic meters and betatron parameters of 200 Units, SGSE for radiation dose, with 30 Units SGSE/min for dose rate are: in aerosols, $2.2 \cdot 10^{-10}$ c/l, in water steam and air, $4 \cdot 10^{-13}$ c/l, and air gases, $1.1 \cdot 10^{-11}$ c/l. (1 Table, 6 References) (JPRS)

18735 RADIATION HEATING OF MATERIALS DURING IRRADIATION WITH CHARGED PARTICLES. Ibragimov, Sh. Sh.; Reutov, V. F.; Abdrashitov, I. Yu. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. 6, 84-85(1974). (In Russian).

The dependence of the temperature of samples on the density

of a beam of α particles (E = 50 MeV) and protons (E = 30 MeV) and the specific radiation losses were determined. The experimental results are presented in graphs. (2 figures) (tr-auth)

18736 THE ABSORPTION OF ULTRAVIOLET RADIATION IN THIN LAYERS OF THORIUM, HAFNIUM, AND ZIRCONIUM OXIDES. Sokolova, R.S. Sov. J. Opt. Technol. 41: No. 10, 454-456 (Oct 1974).

The dependence of the ultraviolet absorption in thin layers of thorium, hafnium, and zirconium oxides on their heat treatment has been investigated. (auth)

18737 MATHEMATICAL METHOD FOR DETERMINING kVp FROM X—RAY ATTENUATION MEASUREMENTS. Joseph, P.M. (Radiology Department, Columbia-Presbyterian Medical Center, New York, New York 10032). Med. Phys. 2: No. 4, 201-207 (July 1975).

A mathematical analysis of the shape of x-ray attenuation curves is presented that suggests a new method of determining the kVp of bremsstrahlung beams. The main result is a simple analytic formula which gives an excellent approximation to the attenuation curve for large thickness of high-Z absorber. From this, a graphical procedure is derived which yields a straight line whose slope is related to the mass attenuation coefficient evaluated at the peak energy. Included are corrections for aluminum filtration, ion-chamber energy dependence, and coherent scattering. The method is limited to beams generated by a constant potential and with negligible characteristic photons in the filtered spectrum. Numerical data are given for using copper absorber below 70 kVcp and tin above 90 kVcp. (auth)

18738 ANNIHILATION OF ANTIPROTONS STOPPED IN HYDROGEN. Dal'karov, O.D.; Kerbikov, B.O. (Institute of Theoretical and Experimental Physics, USSR Academy of Sciences). JETP Lett. 21: No. 5, 134-136 (5 Mar 1975).

The assumption that antiprotons stopped in hydrogen are annihilated directly from atomic states of the $p\bar{p}$ system contradicts the experimental data. The experimentally observed large contribution of the odd orbital momenta to the $p\bar{p}$ annihilation cross section can be attributed to the fact that the annihilation comes from the quasinuclear states of the $p\bar{p}$ system. (auth)

18739 ABSORBED DOSE IN PHANTOMS WHICH REPRESENT VARIOUS AGED MALE HUMANS FROM EXTERNAL SOURCES OF PHOTONS AS A FUNCTION OF AGE. Warner, G. G.; Poston, J. W.; Snyder, W. S. (Oak Ridge National Lab., TN). Health Phys.; 28: No. 5, 599-603(May 1975).

It has long been suggested that there might be a large variation in absorbed dose among various aged humans. One expects this to be the result of the effect of the inverse square law in cases where the sources of radiation are internal. Now, studies have been made with the use of a computer to assess the photon dose received by various phantoms representing different aged male humans due to external sources. The studies included 12 monoenergetic infinite external sources, ranging in energy from 10 keV to 4 MeV and six phantoms, representing a newborn, a 1-yr-old, a 5-yr-old, a 10-yr-old, a 15-yr-old and an adult. The data indicate that dose to the genitalia of a newborn might be three times higher than dose to the genitalia of an adult at higher emitter energies or 30 times as high at the lowest emitter energy. In general, from the 1-yr-old upward in age, dose decreases with age. (auth)

18740 EXPERIMENTAL STUDY OF ELECTRON-PHONON SCATTERING IN METALS. Gantmakher, V. F. (Inst. of Solid State Physics, Chernogolovka, USSR). Rep. Progr. Phys.; 37: 317-362(1974).

The review is devoted to low temperature methods of the study of electron scattering on phonons in metals. The basic emphasis is put on those experiments or those aspects of experiments which are governed by or can yield information about the electron-phonon scattering anisotropy, i.e., the dependence of scattering probability on the electron position on the fermi surface. (auth)

18741 ELECTRONIC STOPPING POWER OF NITROGEN AND OXYGEN FOR LOW ENERGY PROTONS. Dose, V.; Sele, G. (Wuerzburg Univ. (F. R. Germany). Physikalisches Inst.). Z. Phys., A; 272: No. 3, 237-243(Mar 1975). (In German).

The electronic stopping power of molecular oxygen and nitrogen for protons with energies between 1 keV and 30 keV has been measured using a differentially pumped stopping cell. Our results give a surprisingly good confirmation of the Lindhard-Scharff statistical theory which predicts a linear velocity dependence of the electronic stopping power at low projectile energies. The combination of the present measurements with theoretically calculated nuclear stopping powers yields an estimate of the atomic stopping power. This estimate leads to substantially lower atomic stopping powers at low energies compared to values derived from range measurements. (GE)

18742 ON THE ETL EXPOSURE STANDARD FOR LOW ENERGY X-RAYS. Sakihara, K.; Katoh, A. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 277-290(Aug 1974). (In Japanese).

The exposure standard for low energy x-rays has been established at the Electrotechnical Laboratory (ETL). The details of construction of the standard and the procedure of absolute measurement are described. In obtaining the exposure from the ionization by x-rays in the standard ionization chamber, the most important of corrections necessary for undesirable factors are for the following three: the electric field distortion, air attenuation of x-rays and lack of saturation of ionization due to recombination of ions, which are related to one another and difficult to determine separately by usual ways. A new method to measure the shape of the electric field directly has been developed and applied to determination of optimum conditions of geometry of the chamber to minimize the influence of the field distortion. By this method the field distortion is obtained separately from the other correction factors. An investigation is carried out into the correction for the lack of saturation based on the modified Scott and Greening's theory in principle. The space charging effect is analyzed using the relation between the exposure rate and the slope of the corresponding saturation curve in the near saturation region, and the applicability of the above-mentioned theory is examined. Considering the uncertainties of all the correction factors, the error is estimated to be about 1.30% at its maximum value in the absolute measurement. (auth)

18743 C_Δ VALUES FROM MEASURED DISTRIBUTIONS OF ENERGY FLUENCE. Levy, L. B. (Brooke General Hospital, Fort Sam Houston, TX); Waggener, R. G.; Shalek, R. J. (Brooke General Hospital, Fort Sam Houston, TX). Phys. Med. Biol.; 20: No. 2, 324-326(Mar 1975).

Calculations of the absorbed dose conversion factor, C_Δ, require an estimate of the average secondary electron energy. Published values of C_Δ, based on the assumption that the average photon energy is approximately 0.425 of the maximum photon energy in the primary beam were compared with the corresponding C_Δ values calculated from measurements of the relative distributions of energy fluence from four different medical electron accelerators. These latter values were within experimental error of the calculated values, although the measured values were consistently higher. The limitations involved in the assumption of 0.425 hy_{max} as the average photon energy are discussed. (UK)

18744 CALIBRATION DEPTH IN PLASTIC PHANTOMS FOR HIGH ENERGY X- AND GAMMA-RAYS. Dubuque, G. L.; Kereiakes, J. G. (Univ. of Cincinnati). Phys. Med. Biol.; 20: No. 2, 322-324 (Mar 1975).

The recommendations of the Scientific Committee on Radiation Dosimetry of the AAPM on the use of plastic secondary phantoms for the calibration of high energy X- and γ-ray beams are discussed. SCRAD made the assumption that the mass energy transfer coefficients for plastics and water were equivalent, but this introduces errors in calculations of the depths of plastics needed to simulate the calibration depths in water. The small but consistent bias in the calculated dose to water introduced by this conversion error can be eliminated by consideration of the appropriate mass energy transfer coefficients for the plastics and energies of interest. (UK)

18745 GAMMA-RAY DOSE MEASUREMENT IN A HUMAN PHANTOM USING THERMOLUMINESCENT DOSIMETER. Yoon, Y. S.; Lee, H. D. J. Korean Nucl. Soc.; 6: No. 4, 239-247(1974).

A human phantom of polyethylene has been designed and sculptured for studying the effective radiation safety control. The phantom has the approximate size of the Korean adult and was sliced into thirty-five transverse slabs, 2.5 cm thick. The relative dose at the specified position was determined from the exposure that a TLD badge worn on the surface of the phantom body received from external γ-ray. The variation of the exposure as a function of depth in the phantom was measured for uncollimated γ-ray using TLD rods, and also isodose curves were obtained for the anatomical cross-section of the critical organs of the body. To simulate radiation exposure condition in the nuclear facility, measurements were made for given angles of incident γ-ray. The front to back attenuation factor for human phantom of thickness 20 cm was 0.439 for Cs^{137} γ-ray which is in reasonable agreement with the published data. (KSA)

18746 OER OF NEUTRONS FROM 80 MeV DEUTERONS ON BERYLLIUM. Harrison, G. H.; Kubiczek, E. B.; Robinson, J. E. (Maryland Univ., Baltimore). Br. J. Radiol.; 48: No. 569, 409-410(May 1975).

The OER was determined for neutrons from 80 MeV deuterons striking a thick ^{9}Be target for irradiation of Vicia faba bean roots (dose rate 12 rads/minute). The end-point used was the growth increment in 8 days relative to the controls. A comparison with the OER of 2.6 obtained with 250 kVP x rays under similar irradiation conditions demonstrated that an adequate degree of hypoxia had been obtained. Analysis of the results with neutrons gave an OER of 1.32 ± 0.20, and an RBE under oxic conditions of 2.0. This OER value can be compared with that of 1.6 for deuteron energies above 20 MeV (Hall, E. J., 1974. The dependence of RBE and OER on neutron energy for damage to mammalian cells and plant systems (Abstract). Proceedings of Fifth International Congress of Radiation Research, to be published in Radiation Research). The reduction in OER with increasing neutron energy may be a significant factor in selecting existing accelerators or designing new accelerators for radiotherapy. (UK)

Radiation Source Calibration and Standardization

Refer also to abstracts 17246 and 18742.

18747 EXPERIMENTAL TEST OF A NEW METHOD FOR kVp MEASUREMENTS. Joseph, P.M. (Radiology Department, Columbia-Presbyterian Medical Center, New York, New York 10032). Med. Phys. 2: No. 4, 208-212 (July 1975).

We present the results of an experimental test of a new method for measuring the kVp of a diagnostic x-ray beam. The method involves measuring x-ray attenuation in copper or tin absorbers and plotting the attenuation curve in a new way. Our measurements were done at 60, 90, 100, and 120 kVp on a 3-phase, 12-pulse diagnostic generator. The kVp was measured with a calibrated voltage divider-oscilloscope system. Except at 90 kVp, excellent agreement was found, with precisions on the order of ±1%. The 90-kVp point appeared to be somewhat affected by characteristic tungsten radiation and gave agreement with a lower value of precision. (auth)

18748 CALIBRATION OF EXPOSURE RATE OF GAMMA-RAYS. Yamachi, I.; Katoh, A. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 310-316(Aug 1974). (In Japanese).

This paper describes methods and procedures for calibrating the exposure rate of gamma-rays emitted from such nuclides as ^{60}Co, ^{137}Cs and Ra. The calibration of exposure meters and the standard irradiation of personal dosimeters by using calibrated gamma-ray sources are also described. As the results of calibration of some twenty gamma-ray sources conducted at the Electrotechnical Laboratory during ten years, the difference between the value of exposure rate calibrated and the one given in the certificate ranges about 20% at its maximum. The difference is considered to be due to the difference in conditions of the calibration among laboratories. It is recommended to perform the recalibration of the sources under the same condition as that of their practical use. There are two ways for calibration of the gamma-ray exposure rate: one is to determine the exposure rate by comparing it with that of a reference source and the other is to make the calibration with a calibrated exposure meter. The latter is preferred because of its simplicity in the manner and facility to make the calibration under the condition of use. (auth)

Shielding Calculations and Experiments

Refer also to abstracts 18505 and 18947.

18749 (UJV-2995R) MONTE CARLO METHOD AND VARIANCE REDUCTION IN THE SHIELDING CALCULATION. Rataj, J. (Ustav Jaderneho Vyzkumu, Rez (Czechoslovakia)). Feb 1973. 7p. Dep. NTIS (US Sales Only) $4.00.

Several biasing schemes for reducing the variance in the shielding calculation are applied in Monte Carlo calculations of thick shield penetration. Importance sampling, particularly exponential transformation, systematic sampling, Russian Roulette and weighting concepts are utilized and the sampling efficiency in the Monte Carlo calculation is studied. (auth)

18750 PENETRATION OF 6 MeV GAMMA PHOTONS THROUGH LAMINATED SHIELDING SLABS. Bishop, G. B. (Liverpool Univ.); Smitton, C. J. Br. Nucl. Energy Soc.; 14: No. 2, 167-171(Apr 1975).

A well-defined uniform isotropic disc source emitting 6.13 MeV gamma photons from the decay of ^{16}N was used to study photon penetration through laminated layers of lead, steel and polythene. Scalar flux leakage spectra were obtained for measurements using a NaI(Tl) spectrometer whose output was unfolded using the code GAMAK. The problems of evaluating the detector cross section and formation of a response matrix are discussed. For the shield slab thickness considered, the emerging leakage spectra are dominated by the material of the outermost layer. (auth)

18751 CALCULATION OF CROSS SECTIONS OF COHERENT SCATTERING OF GAMMA QUANTA FOR STATISTICAL SIMULATION OF TRANSPORT PROCESSES. Marenkov, O. S. Sov. At. Energy (Engl. Transl.); 37: No. 3, 987-988(Sep 1974).

Translated from At. Energ. (USSR); 37: No. 3, 265(Sep 1974).

A table of coefficients for calculating macroscopic coherent-scattering cross sections (cm^2/g) and error in the approximation of δ is presented. The coefficients were calculated on a computer by the least-squares method using weighting functions of the power type. The table covers 50 elements most frequently encountered in problems on applied and technical nuclear physics. (GMT)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 18472 and 18680.

18752 (CERN-75-8) PROBLEMS OF CLASSICAL DYNAMICAL SYSTEMS. Thirring, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 24 Jun 1975. 31p. Dep. NTIS (US Sales Only) $4.75.

After a brief survey of Hamiltonian theory and of relevant notions of set theory and manifolds, these lectures presented some general properties of orbits, with special attention to integrable systems. This is followed by a discussion of the Kolmogorov-Arnol'd-Moser theorem, dealing with the stability of orbits under small perturbations, and its importance for ergodic theory. Ergodicity and mixing are then treated in detail. In particular, the ergodic theorem of von Neumann is derived, and a specific example is given of a (strongly) mixing system. (auth)

18753 (CNRS-CPT-75-P694) CENTER OF APPROXIMATELY FINITE-DIMENSIONAL C* ALGEBRAS. Bratteli, O. (Centre National de la Recherche Scientifique, 13-Marseille (France). Centre de Physique Theorique). Jan 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

It is proved that any separable abelian C^*-algebra with unit is the center of an approximately finite-dimensional C^*-algebra. (auth)

18754 (ITP-74-77E) ON FIELD FORMULATION OF EQUILIBRIUM CLASSICAL STATISTICAL MECHANICS. II. One-Dimensional Gas. The Simplest Pair Potential. The Absence of Phase Transitions. Skrypnik, W. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

The correlation functions of a one-dimensional continuous infinite Gibbs system with the pair potential $e^{-m|x|}$ are constructed. It is proved that such a system has no phase transitions. (auth)

18755 ERROR ESTIMATES WHEN SOLVING SYSTEMS OF NONLINEAR EQUATIONS BY THE MONTE CARLO METHOD. Kleiza, V. V. (Inst. of Physics and Mathematics, Vilnyus, USSR). Math. Trans. (Engl. Transl.); 13: No. 1, 53-59(1973).

Translated from Litov. Mat. Sb.; 13: No. 1, 79-86(1973).

The error and rate of convergence of the determinant obtained when solving nonlinear equations by the Monte Carlo method are estimated for the n-dimensional case. The theorems proved permit conclusions to be drawn concerning the behavior of the determinant of the Monte Carlo method considered. (SDF)

18756 MACROCAUSALITY AND PARTICLE DENSITY IN RELATIVISTIC WAVE MECHANICS. I. Petzold, J. (Univ., Marburg, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 361-371(Nov 1974). (In German).

Signals represented by scalar particle densities ρ are considered. It is then proven that the assumptions $\rho \geq 0$, $\rho = s^0$ is the fourth component of a four-vector s^μ, the scalar particles form a representation of the Poincaré group in Hilbert space, are incompatible with experimental data (form factors of pions). (auth)

18757 MACROCAUSALITY AND PARTICLE DENSITY IN RELATIVISTIC WAVE MECHANICS. II. Petzold, J. (Univ., Marburg, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 372-380(Nov 1974). (In German).

In relativistic quantum mechanics the excitation of atoms by photons is discussed assuming an electromagnetic interaction of the form $A_\mu j^\mu$. It turns out, that when localized in a region V at a certain time x^0 a photon would excite atoms also outside the light-cone of V. Thus one arrives at a contradiction between quantum mechanics and special relativity. (auth)

18758 MACROCAUSALITY AND PARTICLE DENSITY IN RELATIVISTIC WAVE MECHANICS. III. Petzold, J. (Univ., Marburg, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 381-385(Nov 1974). (In German).

In the framework of relativistic wave-mechanics expressions of particle densities $\bar{\rho}(x)$ with causal behavior are constructed. It turns out that $\rho(x)$ can be neither the fourth component of a four vector nor a local observable. (auth)

18759 PROCEDURE FOR OBTAINING QUANTUM MECHANICAL TRANSFORMATION OF DIAGONALIZATION FROM THE CLASSICAL. Benson, A. K. (Univ. of Indiana, New Albany). Int. J. Theor. Phys.; 12: No. 4, 251-260(Mar 1975).

Using as an example two coupled harmonic oscillators, a transformation to normal coordinates is made using the classical-type simultaneous diagonalization of quadratic forms, and this is then used to develop a procedure for constructing the corresponding quantum mechanical transformation to normal coordinates. The total classical transformation is nonunitary, whereas the quantum mechanical is unitary as it has to be in order to satisfy Von Neumann's theorem. Since the classical transformation has definite steps and is a very straightforward procedure, this could be a very useful procedure for constructing the quantum mechanical transformation in many models, and/or an alternative method for many models. (auth)

18760 SECOND LOOK AT KLEIN'S PARADOX. Wergeland, H. (Trondheim Univ., Norway). Fys. Tidsskr.; 72: No. 2-3, 153-159 (1974). (In Danish).

Though Dirac's relativistic electronic theory is abundantly confirmed by such phenomena as the fine structure of the hydrogen spectrum, the Compton effect, and other evidence, some of its conclusions are remarkable, not least among them Klein's discovery that the electron can penetrate an electronic potential jump which involves a barrier higher than the kinetic energy of the electron, a phenomenon which represents a true paradox since it has nothing to do with the so-called "tunnel effect", the barrier in the present cases being regarded as infinitely broad. Though the expected penetration is very small, this in no way diminishes the principle that a paradox exists; and in some circumstances a transmission approaching unity could be anticipated, the so-called "Ramsauer effect". Suggestions for elucidation of the paradox are examined. (ADN)

18761 MECHANICS OF AN AFFINELY-RIGID BODY. Slawianowski, J. J. (Polska Akademia Nauk, Warsaw). Int. J. Theor. Phys.; 12: No. 4, 271-296(Mar 1975).

The mechanics of an affinely-rigid body is investigated on both the classical and the quantum level. An affinely-rigid body is defined as a system of material points or a continuous medium in which all affine relations are frozen. The present treatment is based on the general theory of systems with closed teleparallelisms. (auth)

18762 BONDI-METZNER-SACHS GROUP IN THE NUCLEAR TOPOLOGY. McCarthy, P. J. (Cambridge Univ., Eng.). Proc. R. Soc. (London), Ser. A; 343: No. 1635, 489-523(27 May 1975).

The Bondi-Metzner-Sachs group is topologized as a nuclear Lie group, and it is shown that irreducible representations arise from either transitive SL(2,C) actions on supermomentum space, or cylinder measures in supermomentum space with respect to which the SL(2,C) action is strictly ergodic. The irreducibles arising from transitive actions are shown to be induced, and most of the theorems from a previous analysis (in which the group was given a Hilbert topology) are generalized so as to apply. All nondiscrete closed subgroups of SL(2,C) are found, and this analysis is used to construct all induced representations whose little groups are not both discrete and infinite. (auth)

18763 RANDOM ELECTRODYNAMICS: THE THEORY OF CLASSICAL ELECTRODYNAMICS WITH CLASSICAL ELECTROMAGNETIC ZERO-POINT RADIATION. Boyer, T. H. (City Coll., New York). Phys. Rev., D.; 11: No. 4, 790-808(15 Feb 1975).

The theory of classical electrodynamics with classical electromagnetic zero-point radiation is outlined here under the title random electrodynamics. The work represents a reanalysis of the bounds of validity of classical electron theory which should sharpen the understanding of the connections and distinctions between classical and quantum theories. The new theory of random electrodynamics is a classical electron theory involving Newton's equations for particle motion due to the Lorentz force, and Maxwell's equations for the electromagnetic fields with point particles as sources. However, the theory departs from the classical electron theory of Lorentz in that it adopts a new boundary condition on Maxwell's equations. It is assumed that the homogeneous boundary condition involves random classical electromagnetic radiation with a Lorentz-invariant spectrum, classical electromagnetic zero-point radiation. The scale of the spectrum of random radiation is set by Planck's constant $\hbar$. In the limit $\hbar$ yields 0, the theory of random electrodynamics becomes Lorentz's theory of electrons. Thus, random electrodynamics stands between two well-known theories--traditional classical electron theory with $\hbar$ equals 0 on the one hand and quantum electrodynamics with its noncommuting operators on the other. The role of boundary conditions in classical electrodynamics, the motivation for choosing a new boundary condition

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PHYSICS (THEORETICAL)

General

Refer also to abstracts 18472 and 18680.

18752 (CERN-75-8) PROBLEMS OF CLASSICAL DYNAMICAL SYSTEMS. Thirring, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 24 Jun 1975. 31p. Dep. NTIS (US Sales Only) $4.75.

After a brief survey of Hamiltonian theory and of relevant notions of set theory and manifolds, these lectures presented some general properties of orbits, with special attention to integrable systems. This is followed by a discussion of the Kolmogorov-Arnol'd-Moser theorem, dealing with the stability of orbits under small perturbations, and its importance for ergodic theory. Ergodicity and mixing are then treated in detail. In particular, the ergodic theorem of von Neumann is derived, and a specific example is given of a (strongly) mixing system. (auth)

18753 (CNRS-CPT-75-P694) CENTER OF APPROXIMATELY FINITE-DIMENSIONAL C* ALGEBRAS. Bratteli, O. (Centre National de la Recherche Scientifique, 13-Marseille (France). Centre de Physique Theorique). Jan 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

It is proved that any separable abelian C^*-algebra with unit is the center of an approximately finite-dimensional C^*-algebra. (auth)

18754 (ITP-74-77E) ON FIELD FORMULATION OF EQUILIBRIUM CLASSICAL STATISTICAL MECHANICS. II. One-Dimensional Gas. The Simplest Pair Potential. The Absence of Phase Transitions. Skrypnik, W. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

The correlation functions of a one-dimensional continuous infinite Gibbs system with the pair potential $e^{-m|x|}$ are constructed. It is proved that such a system has no phase transitions. (auth)

18755 ERROR ESTIMATES WHEN SOLVING SYSTEMS OF NONLINEAR EQUATIONS BY THE MONTE CARLO METHOD. Kleiza, V. V. (Inst. of Physics and Mathematics, Vilnyus, USSR). Math. Trans. (Engl. Transl.); 13: No. 1, 53-59(1973).

Translated from Litov. Mat. Sb.; 13: No. 1, 79-86(1973).

The error and rate of convergence of the determinant obtained when solving nonlinear equations by the Monte Carlo method are estimated for the n-dimensional case. The theorems proved permit conclusions to be drawn concerning the behavior of the determinant of the Monte Carlo method considered. (SDF)

18756 MACROCAUSALITY AND PARTICLE DENSITY IN RELATIVISTIC WAVE MECHANICS. I. Petzold, J. (Univ., Marburg, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 361-371(Nov 1974). (In German).

Signals represented by scalar particle densities ρ are considered. It is then proven that the assumptions $\rho \geq 0$, $\rho = s^0$ is the fourth component of a four-vector s^μ, the scalar particles form a representation of the Poincaré group in Hilbert space, are incompatible with experimental data (form factors of pions). (auth)

18757 MACROCAUSALITY AND PARTICLE DENSITY IN RELATIVISTIC WAVE MECHANICS. II. Petzold, J. (Univ., Marburg, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 372-380(Nov 1974). (In German).

In relativistic quantum mechanics the excitation of atoms by photons is discussed assuming an electromagnetic interaction of the form $A_\mu j^\mu$. It turns out, that when localized in a region V at a certain time x^0 a photon would excite atoms also outside the light-cone of V. Thus one arrives at a contradiction between quantum mechanics and special relativity. (auth)

18758 MACROCAUSALITY AND PARTICLE DENSITY IN RELATIVISTIC WAVE MECHANICS. III. Petzold, J. (Univ., Marburg, Ger.). Ann. Phys. (Leipzig); 31: No. 4, 381-385(Nov 1974). (In German).

In the framework of relativistic wave-mechanics expressions of particle densities $\bar{\rho}(x)$ with causal behavior are constructed. It turns out that $\rho(x)$ can be neither the fourth component of a four vector nor a local observable. (auth)

18759 PROCEDURE FOR OBTAINING QUANTUM MECHANICAL TRANSFORMATION OF DIAGONALIZATION FROM THE CLASSICAL. Benson, A. K. (Univ. of Indiana, New Albany). Int. J. Theor. Phys.; 12: No. 4, 251-260(Mar 1975).

Using as an example two coupled harmonic oscillators, a transformation to normal coordinates is made using the classical-type simultaneous diagonalization of quadratic forms, and this is then used to develop a procedure for constructing the corresponding quantum mechanical transformation to normal coordinates. The total classical transformation is nonunitary, whereas the quantum mechanical is unitary as it has to be in order to satisfy Von Neumann's theorem. Since the classical transformation has definite steps and is a very straightforward procedure, this could be a very useful procedure for constructing the quantum mechanical transformation in many models, and/or an alternative method for many models. (auth)

18760 SECOND LOOK AT KLEIN'S PARADOX. Wergeland, H. (Trondheim Univ., Norway). Fys. Tidsskr.; 72: No. 2-3, 153-159 (1974). (In Danish).

Though Dirac's relativistic electronic theory is abundantly confirmed by such phenomena as the fine structure of the hydrogen spectrum, the Compton effect, and other evidence, some of its conclusions are remarkable, not least among them Klein's discovery that the electron can penetrate an electronic potential jump which involves a barrier higher than the kinetic energy of the electron, a phenomenon which represents a true paradox since it has nothing to do with the so-called "tunnel effect", the barrier in the present cases being regarded as infinitely broad. Though the expected penetration is very small, this in no way diminishes the principle that a paradox exists; and in some circumstances a transmission approaching unity could be anticipated, the so-called "Ramsauer effect". Suggestions for elucidation of the paradox are examined. (ADN)

18761 MECHANICS OF AN AFFINELY-RIGID BODY. Slawianowski, J. J. (Polska Akademia Nauk, Warsaw). Int. J. Theor. Phys.; 12: No. 4, 271-296(Mar 1975).

The mechanics of an affinely-rigid body is investigated on both the classical and the quantum level. An affinely-rigid body is defined as a system of material points or a continuous medium in which all affine relations are frozen. The present treatment is based on the general theory of systems with closed teleparallelisms. (auth)

18762 BONDI-METZNER-SACHS GROUP IN THE NUCLEAR TOPOLOGY. McCarthy, P. J. (Cambridge Univ., Eng.). Proc. R. Soc. (London), Ser. A; 343: No. 1635, 489-523(27 May 1975).

The Bondi-Metzner-Sachs group is topologized as a nuclear Lie group, and it is shown that irreducible representations arise from either transitive SL(2,C) actions on supermomentum space, or cylinder measures in supermomentum space with respect to which the SL(2,C) action is strictly ergodic. The irreducibles arising from transitive actions are shown to be induced, and most of the theorems from a previous analysis (in which the group was given a Hilbert topology) are generalized so as to apply. All nondiscrete closed subgroups of SL(2,C) are found, and this analysis is used to construct all induced representations whose little groups are not both discrete and infinite. (auth)

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Superluminal concepts since 1962 have continued to gain mo-

mentum for numerous discussions. The so-called (yet unconfirmed) tachyons have been basically dealt in the literature with a second-order field equation, leaving aside a probable exploitation through a simpler first-order mechanism. Initiating this (first-order field) approach it is shown that the Dirac invariance under joint reversal symmetries of the mass and four-momentum leads to a (generalized) Lorentz symmetry. This yields solutions of a faster-than-light particle of definite negative mass (referred to here as 'bisiston') with possibly annihilating and other features. How can the "minus" sign in the mass, $-m$, be interpreted? It seems it corresponds to a mass-repulsion process leading to a very probable form of the (missing) $\pm$ symmetry in the mass (i.e. gravitational) interaction (comparable to the universal $V \pm A$ result). This argument appears to be extremely plausible in context of the wide universe where such a symmetry cannot be ruled out in the large. (auth)

18777 ASYMPTOTIC CAUSALITY IN A TWO DIMENSIONAL QUANTUM FIELD THEORY. Screaton, G. R.; Truman, A. (Oxford Univ., Eng.). J. Phys., G (London); 1: No. 4, 381-393(5 May 1975).

The asymptotic causality condition of Screaton is generalized to two dimensions, and it is applied to the vacuum expectation value of the retarded commutator, $R[\phi(x), \phi^+(y)]$, in a two-dimensional field theory. It is proved that the asymptotic causality condition, $\langle 0|R[\phi(x), \phi^+(y)]|0\rangle \sim 0$ for large $(x-y) \notin V_+$, implies the microscopic causality condition, $\langle 0|R[\phi(x), \phi^+(y)]|0\rangle = 0$ unless $(x-y) \in \bar{V}_+$, where V_+ is the forward light cone. In a two dimensional quantum field theory, therefore, the microscopic causality condition can be replaced by the weaker asymptotic causality condition. (auth)

18778 SUPERSYMMETRY IN THE FOUR-DIMENSIONAL LIMIT. Delbourgo, R.; Prasad, V. B. (Imperial Coll. of Science and Tech., London). J. Phys., G (London); 1: No. 4, 377-380 (5 May 1975).

By adopting a dimension-independent definition of the Lagrangian it is found that the action associated with supersymmetric theories in arbitrary dimensions $2l$ is not an invariant (and the associated spinor current is not conserved) except for $l = 2$. Nevertheless, the spinor Ward identities are anomaly free because the offending terms disappear in four dimensions to all orders in $\hbar$. (auth)

18779 GENERAL CONNECTION BETWEEN RANDOM ELECTRODYNAMICS AND QUANTUM ELECTRODYNAMICS FOR FREE ELECTROMAGNETIC FIELDS AND FOR DIPOLE OSCILLATOR SYSTEMS. Boyer, T. H. (City Coll., New York). Phys. Rev., D.; 11: No. 4, 809-830(15 Feb 1975).

A general comparison is presented between random electrodynamics and quantum electrodynamics for the two systems which can be solved exactly in both theories, free electromagnetic fields and point dipole oscillators. The N-point correlation functions of the fields are computed in both theories and are found to differ in general because of the dependence upon the order of the quantum operators within products of operators. However, if all products of quantum operators are symmetrized by taking all permutations of the operator order, then the two theories give identical results for the correlation functions. Analogous results hold to all orders in the fine-structure constant for dipole oscillators in quantum and random electrodynamics. The theories agree only if the quantum operator products are symmetrized. In the limit that the oscillator couplings to the radiation fields vanish, the oscillators can be regarded as mechanical oscillators in quantum mechanics and in random mechanics. The theory of random mechanics is defined in terms of this limit which uncouples a mechanical oscillator from the radiation field. The average values of oscillator variables in random mechanics agree with those of symmetrized products in quantum mechanics. The question is then raised as to the physical significance of the many quantum operators which differ only in the order of their factors. It is pointed out that some operator products which are regarded as physically important, such as the square of the angular momentum, indeed involve unsymmetrized products of operators. On this account the average values of the angular momentum squared in the ground state of an isotropic three-dimensional harmonic oscillator differ between the random-mechanical and quantum-mechanical descriptions. However, there seems to be no case in which experiments have shown that the (unsymmetrized) quantum operator value is to be preferred to that provided by random mechanics. The presence of thermal radiation is next treated for free electromagnetic fields and for dipole-oscillator systems. Despite extraordinary differences in the points of view toward thermal radiation taken by the two theories, the conclusion is the same as that found for zero temperature; the two theories agree in their average values if all products of quantum operators are symmetrized. Finally, as a further example of the power of random electrodynamics to give an account of phenomena where Lorentz's classical electron theory failed, we investigate the diamagnetism of a charged three-dimensional isotropic oscillator. The mathematical descriptions at finite temperature are developed in full random electrodynamics and quantum electrodynamics and in second-order perturbation theory in quantum mechanics. (auth)

18780 SVYAZANNAYA SISTEMA DVUKH CHASTITS V KVANTOVOI ELEKTRODINAMIKE. Lembovskii sdvig urovnei energii. (Related system of two particles in quantum electrodynamics. Lembovskii shift in energy levels). Faustov, R. N. Dubna, USSR; Joint Institute for Nuclear Research (1974). 35p.

This lecture discusses the subject in the areas of the quasi-potential equation in an arbitrary system of reference, construction of the quasi-potential operator, and the Lembovskii shift in energy levels, the quasi-potential of single photon exchange, and the Dawson equation for the two-particle Green function. 13 references. (TTT)

18781 CORRELATION INEQUALITIES AND THE MASS GAP IN $P(PHI)_2$. III. Mass Gap for a Class of Strongly Coupled Theories with Nonzero External Field. Guerra, F. (Salerno Univ. (Italy). Istituto de Fisica); Rosen, L. (Toronto Univ., Ontario (Canada). Dept. of Mathematics); Simon, B. (Princeton Univ., N. J. (USA). Dept. of Mathematics). Commun. Math. Phys.; 41: No. 1, 19-32(Mar 1975).

The infinite volume Dirichlet (or half-Dirichlet) quantum field theory with $P(X) = aX^4 + bX^3 + bX^2 - \mu X (a > 0)$ is considered. If $\mu \neq 0$ there is a positive mass gap in the energy spectrum. If the gap vanishes as $\mu \to 0$, it goes to zero no faster than linearly yielding a bound on a critical exponent. (auth)

18782 RENORMALIZATION AND ASYMPTOTIC BEHAVIOR IN A FINITE QUANTUM FIELD THEORY WITH SHADOW STATES. Chiang, C. C. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (F. R. Germany)). Z. Phys., A; 272: No. 3, 321-324 (Mar 1975).

A study of the renormalization problem in a finite quantum field theory with shadow states for a system of a physical scalar field interacting with a physical fermion field is presented. In order to make the theory finite, two fermion shadow fields are introduced. It is observed that the stability criterion of renormalization cannot be satisfied simultaneously by both physical fields and shadow fields, if the finiteness of the theory is to be maintained. A physical interpretation of this result is given. Furthermore, one finds that the effective complete propagators for large space-like momenta behave like free field propagators without the logarithmic factors observed in the non-Abelian gauge theory. (auth)

18783 NEW CLASS OF BOUND-STATE SOLUTIONS IN FIELD THEORY. Langacker, P. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 1974). Phys. Rev. Lett. 34: No. 25, 1592-1595 (23 June 1975).

It is suggested that bound states can emerge in field theory as alternate solutions to the Bethe-Salpeter equation, not corresponding to the Neumann-series (perturbation-theory) solution. These new solutions are asymptotically similar to elementary-particle solutions and imply nonperturbative anomalous dimensions in the Wilson operator-product expansion. For Goldstone bosons in standard quark models as well as for certain solvable ladder models, these are the only bound-state solutions. (auth)

Gravitation and General Relativity

Refer also to abstracts 18011, 18122, 18165, 18767, and 18768.

18784 SUPERPOSITION OF GRAVITATIONAL WAVES. Griffiths, J. B. (Loughborough Univ. of Tech., Eng.). Mathematical Proceedings of the Cambridge Philosophical Society; 77: No. 3, 559-565(May 1975).

The nature of the non-linear interaction between two gravitational waves in the general theory of relativity is considered. A new exact solution of the vacuum field equations describing this case is given. It describes two gravitational waves with both transverse and longitudinal components, propagating in opposite directions along "shearing" and "twisting" geodesic congruences with zero contraction. (auth)

18785 THEORY OF SHOCK WAVES DISSIPATION IN HOMOGENEOUS STATIONARY MOVING MEDIA. Novak, A. F. (Kiev Inst. of Cultivation). Astrometriya Astrofiz.; No. 26, 38-46(1975). (In Russian).

The equations are obtained describing the shock wave motion through plane, cylindrical and spherical gravitational atmospheres, with regard for dissipation of the energy, steary-mass motions,

arbitrary distributions of temperature and density. Particular cases of strong and weak shock waves propagation in isothermal or adiabatic atmospheres are discussed. (24 refs.) (auth)

18786 STABILITY OF KERR'S SPACE–TIME. Stewart, J. M. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Proc. R. Soc. (London), Ser. A; 344: No. 1636, 65-79(3 Jun 1975).

The stability of Kerr's space–time with $|a| < M$, in the usual notation, against infinitesimal perturbations is discussed. No exponentially growing "normal modes" occur. However, since (a) the exponentially decaying modes have not been shown to be complete, (b) there are normal modes with real frequencies, the stability of the Kerr space-time has not been established rigorously. (auth)

18787 SOME PHYSICAL IMPLICATIONS OF A NEW RELATIVISTIC BOUNDARY CONDITION. Kofinti, N. K. (International Centre for Theoretical Physics, Trieste, Italy). Int. J. Theor. Phys.; 12: No. 4, 261-270(Mar 1975).

It is shown that a new boundary condition in general relativity can be interpreted as a condition on the rate of spinning in a model for the gravitational field of an isolated body embedded in Trautman's expanding universe of spinning particles. The new condition is also shown to be independent of the usual O'Brien–Synge conditions in the sense that it is not an identity following from them. The validity of the delta function technique employed in deriving the above new boundary condition is investigated in a nonrelativistic framework. The technique is shown to yield familiar nonrelativistic results as well as a new one which involves rate-of-strain and pressure-gradient in the case of an adiabatic flow such as in a compressible fluid with an isentropic equation. (auth)

18788 ON THE EFFECT OF SPIN ON THE GRAVITATIONAL FIELD. Kofinti, N. K. (Univ. of Durham, Eng.). Int. J. Theor. Phys.; 12: No. 4, 241-249(Mar 1975).

Using a solution of Trautman's recently formulated Einstein–Cartan equations ("On the Structure of the Einstein–Cartan Equations", Warsaw Univ. Preprint 1FT/72/13 (1972)), it is shown that if an isolated body is embedded in an expanding universe consisting of a dust of spinning particles, then the local gravitational field of the body is influenced by spin, even when the cosmological constant is neglected. (auth)

18789 ZERO VALUE OF THE SCHWARZSCHILD MASS FOR AN ASYMPTOTICALLY EUCLIDIAN SYSTEM OF GRAVITATIONAL WAVES. Folomeshkin, V. N. (Inst. Fiziki Uysokikh Ehnergy, Serpeikhov, USSR). Int. J. Theor. Phys.; 12: No. 3, 169-176(Feb 1975).

A class of asymptotically Euclidian space-times is shown to exist for which the Schwarzschild mass is equal to zero. The coordinate atlases of these space-times satisfy two additional conditions: $\partial_k(-gg^{0k}) = 0$ and $\Gamma^0_{ik}\partial_0 g^{ik} - \Gamma^k_{ik}\partial_0 g^{0i} = 0$. In a T-orthogonal metric $ds^2 = g_{00}dt^2 - g_{\alpha\beta}dx^\alpha dx^\beta$ these conditions take a simple form: $\partial_0(\det g_{\alpha\beta}) = 0$ and $(\partial_0 g^{\alpha\beta})(\partial_0 g_{\alpha\beta}) = 0$. (auth)

18790 INFINITIES OF THE MASSLESS SPIN-½ TRIANGLE DIAGRAM IN QUANTUM GRAVITY. De Meyer, H. E. (Univ., Ghent). J. Phys., A (London); 8: No. 5, 773-781(May 1975).

In a massless fermion-graviton interaction field theory, the triangle graph with three external graviton lines is considered. The infinities arising from this and associated graphs are calculated in the dimensional regularization scheme, putting the energy-momentum of one of the external legs equal to zero. These infinities are exactly cancelled by those of the three-graviton graph originating from the graviton self-energy counter-Lagrangian density. (auth)

18791 GEODESIC DISTANCE IN A RIEMANN SPACE-TIME IN A SECOND POST-MINKOWSKI APPROXIMATION. John, R. W. Z. Angew. Math. Mech.; 54: 737-740(1974). (In German).

A Riemann space-time manifold is considered and the geodesic distance is introduced for two points which are sufficiently close to each other. Attention is given to symmetry relations, the representation of the solution of the differential equations, and the Schwarzschild line element for the gravitational field of a central mass. The square of the geodesic distance of two points in the external Schwarzschild field is obtained, taking into account the second approximation. (IAA)

18792 INTERACTION OF A PHOTON WITH A GRAVITATIONAL FIELD. Crawford, D. F. (Univ. of Sydney). Nature (London).; 254: No. 5498, 313-314(27 Mar 1975).

It is stated that it is usual to analyse the behaviour of photons in gravitational fields as if they were point particles which travel along geodesics. But by taking into account the finite spatial extent of the photon it is shown that it could interact with the transverse gradient of the gravitational field to give a deflection additional to the well known gravitational deflection of General Relativity. It is postulated that this deflection, even though it is extremely small, could be the basis for a much more important effect in which the photon can decay into three photons (or possibly several photons with one or more gravitons). If such a mechanism is possible it would appear as a decrease in photon energy and could be of astrophysical importance in explaining many of the anomalous redshifts that have been observed. In some situations the secondary photons which are expected to have very low energies may be observed as low frequency radio waves. (auth)

18793 DECOMPOSITIONS OF GRAVITATIONAL PERTURBATIONS. Moncrief, V. (Department of Physics, University of Utah, Salt Lake City, Utah 84112). J. Math. Phys. (N.Y.) 16: No. 8, 1556-1560 (Aug 1975).

We consider the Brill–Deser decomposition of the perturbations of a flat spacetime with compact Cauchy hypersurfaces. We propose a generalization of the Brill–Deser splitting which may be applied to the perturbations of arbitrary vacuum spacetimes with compact Cauchy slices. We split the space of perturbations of any allowed Cauchy data set into three subspaces which, with suitable inner product, are mutually orthogonal. Two of these subspaces comprise the solution set of the perturbed constraint equations, and one of these two subspaces represents pure gauge perturbations. Some possible applications of these splittings to the study of the vacuum perturbation equations and to the linearization stability problem for the Einstein equations are briefly discussed. (auth)

18794 ELEMENTARY SYSTEMS IN GENERAL RELATIVITY. Maia, M. D. (Departamento de Matemática, Universidade de Brasília, 70.000, Brasília, D. F., Brazil). J. Math. Phys. (N. Y.) 16: No. 8, 1686-1691 (Aug 1975).

The problem of definition of elementary systems in general relativity is analyzed and some current theories are compared. A definition of dynamically free local elementary systems in general relativity is proposed, taking into account the influence of the gravitational field arising from the intrinsic dependence of the symmetry groups on the field. (auth)

REACTOR TECHNOLOGY AND REGULATION

18795 TRENDS IN DEVELOPMENT OF NUCLEAR POWER ENGINEERING. Ermakov, G. V.; Lavrenenko, K. D. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 1-7(Jun 1974).
Translated from Teploenergetika; 21: No. 6, 2-5(Jun 1974).
The development and status of nuclear power in the USSR is reviewed. Nuclear power in other countries is also examined comparatively. (JWR)

18796 EXPERIENCE WITH OPERATION OF NUCLEAR POWER STATIONS IN THE USSR. Voronin, L. M. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 8-15(Jun 1974).
Translated from Teploenergetika; 21: No. 6, 5-11(Jun 1974).
The development of nuclear power in the USSR is reviewed. Nuclear power stations with WWER type reactors, channel type uranium-graphite reactors, and fast reactors are discussed. (JWR)

18797 TRAINING ENGINEERS IN THE FIELD OF NUCLEAR ENGINEERING. Margulova, T. Kh. (Moscow Power Inst.). Therm. Eng. (USSR) (Engl. Transl.);21: No. 6, 32-35(Jun 1974).
Translated from Teploenergetika; 21: No. 6, 23-25(Jun 1974).
The nuclear engineering program at the Moscow Power Institute is reviewed. (JWR)

18798 NEW AREAS OF INVESTIGATIONS IN THE FIELD OF NUCLEAR POWER ENGINEERING. Krasin, A. K. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 16-21(Jun 1974).
Translated from Teploenergetika; 21: No. 6, 11-15(Jun 1974).
Stages of development of nuclear power in the USSR are discussed. Forecasts for future development are made and some possible additional uses of nuclear power are described. (JWR)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 19119–19122, 19124, 19128, 19130, 19132, 19149, and 19153.

18799 (CONF-750614-2) DOMESTIC PARTICIPATION IN A NUCLEAR POWER PROJECT. Lane, J. A. (Oak Ridge National Lab., Tenn. (USA)). 1975. 26p. Dep. NTIS $4.50.
From IAEA interregional seminar on nuclear power planning; Kingston, Jamaica (9 Jun 1975).
Design characteristics of PWR, BWR, HTGR, and PHWR type reactors are compared. The manufacture of nuclear plant components by local industries is analyzed. (DCC)

18800 (JEN-297) INFORMATION TO BE REQUESTED FROM THE NSSS VENDOR FOR FUEL MANAGEMENT CAPABILITY FOR BWR. Minguez, E.; Esteban, A.; Gomez, M.; Leira, G.; Martinez, R.; Serrano, J. (Junta de Energia Nuclear, Madrid (Spain)). 1975. 23p. (In Spanish). Dep. NTIS (US Sales Only) $4.25.
A set of the nuclear, thermal-hydraulic, and mechanical parameters necessary according to the design of BWR's is listed. These parameters are necessary to perform the fuel management and it must be supplied by the reactor manufacturer to the utility. (auth)

18801 (NEDO-10802-2) ANALYTICAL METHODS OF PLANT TRANSIENT EVALUATIONS FOR THE GE BWR, AMENDMENT NO. 2. Baham, S. E.; Linford, R. B. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Jun 1975. 53p. Dep. NTIS $5.75.
Additional information regarding Licensing Topical Report NEDO-10802, Analytical Methods of Plant Transient Evaluations for the General Electric Boiling Water Reactor, was requested through a letter to Mr. Ivan F. Stuart from Mr. W. R. Butler, dated December 18, 1974. The first amendment, NEDO-10802-1, dated April 1975, responded to some of the requests. This second amendment, NEDO-10802-2, addresses the remaining requests. (auth)

18802 (ORNL-3578) DESIGN GUIDE FOR HEAT TRANSFER EQUIPMENT IN WATER-COOLED NUCLEAR REACTOR SYSTEMS. (Oak Ridge National Lab., Tenn. (USA)). Jul 1975. Contract W-7405-eng-26. 498p. Dep. NTIS $28.00.
Information pertaining to design methods, material selection, fabrication, quality assurance, and performance tests for heat transfer equipment in water-cooled nuclear reactor systems is given in this design guide. This information is intended to assist those concerned with the design, specification, and evaluation of heat transfer equipment for nuclear service and the systems in which this equipment is required. (auth)

18803 (RT/ING-(74)27) PARMENIDE: A DIGITAL COMPUTER PROGRAM FOR THERMAL-HYDRAULIC BUNDLE ANALYSIS OF LARGE BWR CORES. Marinelli, V.; Pastori, L. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1974. 23p. Dep. NTIS (US Sales Only) $4.25.
The PARMENIDE computer code, written in FORTRAN IV language for IBM 360 systems calculated the flow rate, steam quality, void fraction distributions and the pressure drops of BWR cores, under steady-state conditions. The coolant analysis is performed subdividing the core into groups of channels having the same geometrical and thermal characteristics or even considering each fuel element individually. The latter possibility is the peculiarity of the code and allows the exact determination of the thermohydraulic conditions existing in the largest BWR of the present generation (BWR/6). The maximum acceptable number of channels different from each other in geometrical characteristics, number and shape of spacers, radial and axial power distribution is 1,000. (auth)

18804 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY CONFERENCE ON REACTOR OPERATING EXPERIENCE, ALBUQUERQUE, NEW MEXICO, AUGUST 3-6, 1975. Farmakes, R. (ed.). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 1-30(1975).
Summaries of 38 papers are presented concerning operational quality assurance, research reactor operating experiences, power reactor operating experiences, reactor simulators, refueling experiences, procedures and administrative controls, and as-low-as-practicable in operations. (DCC)

For abstracts of individual papers see: 18805–18816, 18825–18831, 18890–18897, 19146–19148, 19170, 19194, and 19214–19219.

18805 NDT-ACOUSTICS EXAMINATION OF KRB NUCLEAR STEAM SUPPLY SYSTEM. Ascherl, R. J. (Exxon Nuclear Co., Bellevue, WA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 1(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18806 VIBRATION AND LOOSE-PARTS MONITORING EXPERIENCE ON NUCLEAR POWER STATIONS. Pekrul, P. J. (Rockwell International, Canoga Park, CA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 1-2(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18807 OPERATING EXPERIENCES OF THE MONTICELLO NUCLEAR GENERATING PLANT. Clarity, M. (Northern States Power Co., Monticello, NM). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 10-11(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18808 BRUNSWICK UNIT NO. 2 STARTUP: CAROLINA POWER AND LIGHT COMPANY. Holder, J. R. (Carolina Power and Light Co., Raleigh, NC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 11-12(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18809 UTILITY'S LOOK AT SIMULATORS. Kenyon, B. D. (Northeast Nuclear Energy Co., Waterford, CT). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 14(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18810 GENERAL ELECTRIC BWR SIMULATORS: INTERNATIONAL AND DOMESTIC. Nash, J. E. (General Electric Co., San Jose, CA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 14-15(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18811 SO-CALLED REFUELING OUTAGE. Stephenson, B. B. (Commonwealth Edison Co., Morris, IL). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 20-21(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18812 REFUELING EXPERIENCES AT VERMONT YANKEE. Edwards, D. W. (Yankee Atomic Electric Co., Westboro, MA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 21-22(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18813 EXTENDING SPENT FUEL STORAGE CAPACITY IN OPERATING NUCLEAR PLANTS. Rubinstein, H. J.; Clark, P. M. (Nuclear Services Corp., Campbell, CA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 22(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18814 ADMINISTRATIVE CONTROL OF NUCLEAR PLANT MAINTENANCE ACTIVITIES. Foster, E. R. (Northeast Nuclear Energy Co., Waterford, CT). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 24-25(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18815 INSTRUMENT AND LOGIC SYSTEM SURVEILLANCE TESTING AT COOPER NUCLEAR STATION. Meyer, K. L.; Noyes, C. R. (Nebraska Public Power District, Brownville). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 25(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18816 YANKEE ATOMIC'S METHODS FOR ASSURING AS-LOW-AS-PRACTICABLE OCCUPATIONAL EXPOSURES. MacDonald, J. A. (Yankee Atomic Electric Co., Westboro, MA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 29(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18817 THE KRUEMMEL 1,300 MW NUCLEAR POWER STATION. Mitschel, H. (Hamburgische Electricitaets-Werke A. G. (F. R. Germany). Abt. Maschinenbau); Banz, P. (Kraftwerk Union A. G., Offenbach (F. R. Germany). Hauptbereich Reaktortechnik); Lange-Stalinski, K. (Kraftwerk Union A. G., Offenbach (F. R. Germany). Hauptbereich Vertrieb). Atomwirtsch., Atomtech.; 20: No. 2, 66-73(Feb 1975). (In German).

Nordwestdeutsche Kraftwerke AG (NWK) and Hamburgische Electricitaetswerke (HEW) in mid-1971 decided to jointly build a large nuclear power station at Kruemmel and established the Kernkraftwerk Kruemmel GmbH (KKK) to build and operate that station. In July 1972, Kraftwerk Union AG (KWU) was awarded the order for planning the power station on a turnkey basis and supplying the nuclear steam generating system with a boiling water reactor, the turboset, and the other mechanical and electrical parts, plus the initial fuel inventory. The 1,300 MW nuclear power station at Kruemmel will be equipped with a boiling water reactor of the type used at a lower power level in the nuclear power stations of Brunsbuettel, Philippsburg-1 and 2, Isar, and the Austrian nuclear power station at Tullnerfeld. The Kruemmel Nuclear Power Station will be the first plant to have internal axial pumps for circulating the coolant inside the reactor. Because of the long delay caused by the licensing procedure the Kruemmel Nuclear Power Station will not be delivered before August 1978 after a total construction period of 55 months. (auth)

18818 RECENT TRENDS IN BWR NUCLEAR POWER PLANTS. Oki, A. (Hitachi Ltd., Tokyo (Japan)); Hamada, K. Hitachi Hyoron; 56: No. 9, 882-888(Sep 1974). (In Japanese).

The boiling water reactor (BWR) nuclear power generation system has undergone extensive development and application and is now firmly established as a major choice in the world nuclear power industry. The most recent addition to the BWR product line, called BWR/6, has been developed in order to fulfill the demand for higher capacity while improving on plant economy and reliability. The added features of a standard BWR/6 power station and the history of BWR development are described. (auth)

18819 SHIMANE NUCLEAR POWER PLANT UNIT 1, CHUGOKU ELECTRIC POWER COMPANY STARTUP TEST AND RESULTS. Yakushiji, K.; Niki, Y. (Chugoku Electric Power Co. Inc., Hiroshima (Japan)); Suematsu, S. Hitachi Hyoron; 56: No. 9, 873-881(Sep 1974). (In Japanese).

The No. 1 generating unit installed at the Shimane Nuclear Power Plant was put in commercial operation on March 29, 1974, after passing extensive start-up tests. The start-up tests took 11 months in all, including 4 months spent in overall inspection of the plant because of the fault found in the assembly of the imported control rods. General operation results, reactor static characteristic tests, plant dynamic characteristic tests, and plant overall performance tests are reported. (auth)

18820 TOPICS ON DESIGN OF BWR CORE AND FUEL. Murota, K.; Miyamoto, T. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Toshiba Rebyu; 29: No. 9, 802-806(Sep 1974). (In Japanese).

Boiling water reactors are adopting 8 × 8 fuels as initial and reload fuels in order to attain higher reliability and safety of power generation. Some topics are described on 8 × 8 fuel design such as (1) incentives for 8 × 8 fuels, (2) special features of 8 × 8 fuel and core design, and (3) performance characteristics. (auth)

18821 MODIFIED ONE-GROUP DIFFUSION SCHEME FOR CALCULATING GROSS POWER DISTRIBUTION IN A BWR CORE. Tsuiki, M.; Aoki, K. (Nippon Atomic Industry Group Co. Ltd., Kawasaki, Kanagawa. Nuclear Research Lab.). J. Nucl. Sci. Technol. (Tokyo); 11: No. 9, 369-377(Sep 1974).

A new modified one-group diffusion scheme for one- and two-dimensional calculations of the gross power distribution in the BWR core is presented. The uniqueness of the present method is that the fine distribution of the ratio between thermal and fast neutron fluxes within each fuel assembly is estimated analytically. Since this estimation can be performed locally and without requiring knowledge of the fast neutron distribution, the method is quite effective in reducing computing time. Procedures for special treatment at the two-dimensional core-reflector boundaries are also derived from analytical considerations. The results obtained from a series of test calculations indicate that the present method assures an accuracy almost equal to the conventional two-group calculation, and without requiring much more computing time than the conventional one-group calculation. The applicability of the method to three-dimensional calculations is also discussed. (auth)

18822 REPORT TO THE AMERICAN PHYSICAL SOCIETY BY THE STUDY GROUP ON LIGHT-WATER REACTOR SAFETY. Lewis, H.W. (University of California, Santa Barbara, California 93106); Budnitz, R.J.; Castleman, A.W.; Dorfan, D.E.; Finlayson, F.C.; Garwin, R.L.; Hebel, L.C.; Keeny, S.M. Jr.; Muller, R.A.; Taylor, T.B.; Smoot, G.F.; von Hippel, F.; Bethe, H.; Panofsky, W.K.H.; Weisskopf, V.F. Rev. Mod. Phys. 47: No. 1, S1-S123 (16 June 1975).

The issue of light-water reactor (LWR) safety has been the subject of a part-time, year-long study sponsored by the American Physical Society. The goal of the study was the assessment of some of the technical aspects of the safety of large light-water nuclear power reactors typical of present commercial practice in the United States. The report examines issues related to safe operation of LWRs; the research and development program responsible for establishing and enhancing safety; and the consequences of accidents for public health and welfare. The report in no way deals with the need for nuclear power or its benefits, and should not be considered as a net assessment of the risks versus the benefits of nuclear reactors. Since the risks of ecological impacts of other energy technologies are not addressed, no recommendations are made concerning the specific reactor program which should be followed in the immediate future. Among the areas covered in the report are primary pressure-vessel integrity; quality assurance; accident initiation from operator error, transients, and sabotage; the adequacy of present emergency core-cooling system designs; the calculation of long-term consequences to health of one particular low-probability accidental release of radioactivity; and the experimental and calculational (computer-code-development) aspects of the present reactor safety research program. A number of recommendations are contained with the report, mainly addressed to ways in which the safety of the present LWRs can be improved or better understood. (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 18799, 18802, 18804, 18806, 18809, 18813, 18816, 18822, 19115, 19120, 19124, 19125, 19131, 19132, 19148, 19195, and 19211.

18823 (BAW-3647-34) PHYSICS VERIFICATION PROGRAM. Part IV, Task I. Quarterly Technical Report, December 1974–March 1975. Baldwin, M. N. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Research and Development Div.). May 1975. Contract AT(11-1)-3109. 29p. Dep. NTIS $4.50.

The reactivity and power perturbation effects of poison and neutral pins in mockups of 15 by 15 fuel assemblies are being measured. The experimental facility—a water-moderated, 4% enriched UO_2 lattice—is arranged to mock up the fuel assemblies of the Consolidated Nuclear Steam Generator (CNSG) core. (auth)

18824 (NP-20432) CHEMICAL, BIOLOGICAL, AND CORROSION INVESTIGATIONS RELATED TO THE TESTING OF THE DIABLO CANYON UNIT 1 COOLING WATER SYSTEM. Warrick, J. W.; Sharp, S. G.; Friedrich, S. J. (Pacific Gas and Electric Co., San Francisco, Calif. (USA). Dept. of Engineering Research). 1975. 46p. Pacific Gas and Electric Co., San Francisco, CA.

The investigations studying copper releases and the potential contamination of marine organisms resulting from the testing of the Diablo Canyon Nuclear Power Plant's Unit 1 cooling water system in 1974 and early 1975 are summarized. The cooling water system is described and system testing and associated

biological observations stemming from condenser system corrosion are traced. The investigation includes an examination of preventive measures introduced to prevent recurrence of the problems. (auth)

18825 OPERATING EXPERIENCES OF THE ZION NUCLEAR POWER STATION. Bitel, J. (Commonwealth Edison Co., Zion, IL). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 10(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18826 PLANT SIMULATION: ITS ROLE IN THE COMPANY TRAINING PROGRAM. Thomas, E. L. (Duke Power Co., Charlotte, NC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 15-16(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18827 RELAP-4 THERMAL-HYDRAULIC ANALYSIS OF THE MAINE YANKEE SPENT FUEL PIT. Metevia, W. J.; Husain, A.; Hencey, T. R. (Yankee Atomic Electric Co., Westboro, MA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 18-19(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18828 H. B. ROBINSON REFUELING EXPERIENCES. Hammond, J. G. (Carolina Power and Light Co., Hartsville, SC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 19-20(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18829 REFUELING OUTAGE SYSTEM TO INCREASE PLANT AVAILABILITY. Cognevich, M. L.; Olmstead, C. A. (Westinghouse Electric Corp., Pittsburgh, PA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 20(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18830 ADMINISTRATIVE CONTROL OF ABNORMAL AND EMERGENCY SITUATIONS THROUGH PROCEDURES AT TURKEY POINT PLANT. Wethy, C. M. (Florida Power and Light Co., Miami). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 25-26 (1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18831 HEALTH PHYSICS TRAINING PROGRAM FOR THE OCONEE UNIT 1 FUELING OUTAGE. Haller, W. A.; Lewis, L.; Lochamy, J. C. Jr. (Duke Power Co., Charlotte, NC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 29-30(1975).
From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18832 VIBROACOUSTIC DIAGNOSIS OF THE STATE OF THE MAIN CIRCULATION PUMPS OF THE FIRST LOOP IN A NUCLEAR POWER STATION WITH WATER-MODERATED WATER-COOLED REACTORS. Samarin, A. A.; Adamenkov, K. A. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 27-31(Jun 1974).
Translated from Teploenergetika; 21: No. 6, 19-23(Jun 1974).
Techniques for the vibroacoustic monitoring of pumps in WWER primary loops are described. (JWR)

18833 VENTILATION SYSTEM IN THE CONTROL RANGE OF A LIGHT-WATER REACTOR. Pecornik, D. (Brown, Boveri und Cie A. G., Mannheim (F. R. Germany)). At. Strom; 21: No. 3/4, 18-22(Mar 1975). (In German).
The creation and maintenance of the correct climatic and radiological conditions in light-water reactors where there is radiation danger are discussed. The emission of radioactive exhaust gases during correct operation and in case of breakdown is examined. The ventilation installations and their function in relation to a pressurized water reactor are described. (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 18799, 19123, 19133, and 19135.

18834 (GA-A-12910(AMEND.2)) THERMAL CONDUCTIVITY OF LARGE HTGR FUEL RODS, AMENDMENT NO. 2. Johnson, L. D. (General Atomic Co., San Diego, Calif. (USA)). 27 Jun 1975. 43p. (GA-LTR-7(AMEND.2)). General Electric, San Diego, CA.

18835 (GA-A-13336) PREPLACED AGGREGATE CONCRETE APPLICATION ON FORT ST. VRAIN PCRV CONSTRUCTION. Ople, F. S. Jr. (General Atomic Co., San Diego, Calif. (USA)). 18 Apr 1975. Contract AT(04-3)-633. 14p. Dep. NTIS $4.00.
Two distinct concreting methods were employed in the construction of the prestressed concrete reactor vessel (PCRV) of the Fort St. Vrain (FSV) Nuclear Generating Station, a 330 MW(e) High Temperature Gas-Cooled Reactor installation near Denver, Colorado. Preplaced aggregate concrete (PAC) techniques were employed in the PCRV bottom head and the core support floor; conventional job-mixed concrete was used in the PCRV sidewall and top head regions. The successful application of PAC techniques utilized primarily in solving construction difficulties associated with confined and heavily congested regions of the PCRV is described. The PAC technique consists of placing coarse aggregate inside the forms, followed by injection of grout under pressure through embedded pipes to fill the interstices in the aggregate mass. Details of the PAC construction method including grout mix development, grouting equipment, grout pipe layout, grouting sequence, grout level monitoring, concrete temperature control, and pre-construction mockups are described. (auth)

18836 (GA-A-13351) CONSTRUCTION, TESTING, AND INITIAL OPERATION OF FORT ST. VRAIN PCRV. Ople, F. S. Jr.; Neylan, A. J. (General Atomic Co., San Diego, Calif. (USA)). 18 Apr 1975. Contract AT(04-3)-633. 15p. Dep. NTIS $4.00.
The Fort St. Vrain (FSV) Nuclear Generating Station is the first station in the USA to use a prestressed concrete reactor vessel (PCRV). The PCRV was designed and constructed by General Atomic. Construction of the PCRV was completed in 1970; the pressure and leak tests were completed in 1971. The structural behavior of the PCRV has been monitored by installed instrumentation since start of construction. The highlights of the actual construction, testing, and initial operation of the PCRV, including a comparison of structural behavior, where possible, between observed data and analytical predictions are described. (auth)

18837 (GKSS-75/E/3) IRRADIATION RESEARCH ON FUEL RODS WITH POISON CORE. Muellauer, J.; Schmeizer, F.; Schmitt, F. J.; Spalthoff, W. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1975. 30p. (In German). Dep. NTIS (US Sales Only) $4.50.
After a preliminary examination in the unirradiated state on the compatibility behavior between UO_2 ring tablets and graphite rods with admixtures of B, two fuel rods with poisoned center were irradiated in the L2 gas loop. Three short fuel rods with poisoned center were irradiated in the HFR in Petten, Netherlands. Post-irradiation examinations showed that whereas the rods irradiated in the gas loop had no signs of a reaction between fuel rod and poisoned center, strong reactions occurred in the rods irradiated in the HFR. The results also showed that fuel rods with a poisoned center can be loaded up to a maximum linear power generation rate of 550 W/cm. (tr-auth)

18838 (RD/B/N-3331) SOFTWARE MANUAL FOR THE GAMMA SCANNING MACHINE AT THE A. G. R., POST-IRRADIATION EXAMINATION PLANT, A. E. E. WINFRITH. Raine, S. M.; Polley, M. V.; Davies, B. S. J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 131p. Dep. NTIS (US Sales Only) $9.75.
The gamma scanning system of the AGR PIE plant at AEE Winfrith is controlled by PDP 11/20 computer with 8k words of memory. The program, written in PAL 11 language, enables gamma scanning to be performed on two rigs simultaneously. A choice of several scanning sequences or several single purpose routines is available and these are initiated by commands typed on the keyboard of a teletype. A brief summary of the basic software system is given together with a complete listing of the gamma scanning program in the appendices. Preceding each routine listing is a statement of the function of the routine and an explanation of how the function is achieved. A core allocation is given and a set of flow diagrams. This software manual is intended for use in conjunction with the operating manual. (auth)

18839 MIXTURES OF GASES AS FUTURE WORKING MEDIA FOR CLOSED CYCLE GAS TURBINE PLANTS. Tetel'baum, S. D. (Odessa Polytechnic Inst.). Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 106-110(Jun 1974).
Translated from Teploenergetika; 21: No. 6, 75-78(Jun 1974).
The properties of a mixture of helium and carbon dioxide are evaluated with respect to the use of this mixture as a working fluid in gas turbine reactors. (JWR)

18840 OUTLINE OF RESEARCH AND DEVELOPMENT ON PRESSURE VESSEL STRUCTURE FOR THE PROTOTYPE HEAVY WATER MODERATED BOILING LIGHT WATER COOLED REACTOR FUGEN. Shibato, E.; Oguchi, I. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works); Usami, S.; Minato, A. Hitachi Hyoron; 56: No. 9, 901-906(Sep 1974). (In Japanese).

The prototype heavy water moderated boiling light water-cooled reactor Fugen is now undergoing development work as a national project by the Power Reactor and Nuclear Development Corporation. The structure of the pressure vessel of the Fugen consists of pressure tube assemblies, a calandria, and thermal shields. This made it imperative to carry out numerous research and development programs prior to the design, fabrication, inspection and testing, and inservice inspection of the prototype. Research and development work relating to the prototype pressure vessel is outlined. (auth)

18841 PRELIMINARY STUDY ON HIGH TEMPERATURE HEAT EXCHANGER FOR NUCLEAR STEEL MAKING. Ikegami, H. (Nippon Kokan K. K., Tokyo); Mori, Y. Tetsu To Hagane; 60: No. 8, 1166-1178(Jul 1974). (In Japanese).

High temperature heat exchangers were studied for application in steel making with high temperature gas cooled reactors. The study was performed on the characteristics of the heat exchangers, hydrogen permeability through heat-resistant material, creep test of heating tubes, and hydrogen elimination test by titanium sponge. The system consists of a high temperature heat exchanger, a medium temperature heat exchanger, a low temperature heat exchanger, a heater, a helium tank, a surge tank, a helium compressor, a hydrogen absorber, an auxiliary hydrogen absorber, a helium cooler, a regenerative heat exchanger and two filters. The experimental heat transfer coefficient was 20 to 40% larger than the calculated one. Experimental heat loss was larger than the calculated value. The permeability of hydrogen through Incoloy 800 and Inconel 600 was observed, calculation of carbon deposition was carried out, and high temperature oxidation was investigated. Creep tests were made for the samples of Incoloy 800 and Inconel 600. Burst, decarbonization, circumferential distortion, mechanical properties, microscope observation, and oxidation were studied. Experimental results on the hydrogen elimination with titanium sponge are presented. (JA)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 18799 and 19193.

Power Reactors, Breeding

Refer also to abstracts 17052, 18926, 19112–19114, 19127, 19133, and 19150.

18842 (ANL-75-5) COMPUTATION OF THE EFFECT OF PIPE PLASTICITY ON PRESSURE-PULSE PROPAGATION IN A FLUID SYSTEM. Youngdahl, C. K.; Kot, C. A. (Argonne National Lab., Ill. (USA)). Apr 1975. Contract W-31-109-Eng-38. 43p. Dep. NTIS $4.00.

A simple computational model is developed for incorporating the effect of elastic-plastic deformation of piping on pressure-transient propagation in a fluid system. A computer program (PLWV) is described that incorporates this structural interaction model into a one-dimensional method-of-characteristics procedure for fluid-hammer analysis. Computed results are shown to be in good agreement with available experimental data. The most significant effect of plastic deformation is to limit the peak pressure of a pulse leaving a pipe to approximately the yield pressure of the pipe, if the pipe is sufficiently long. 7 references. (auth)

18843 (ANL-CT-75-31) STRUCTURAL REACTIVITY FEEDBACK EFFECTS IN THE GAS COOLED FAST REACTOR. McLennan, G. A.; Sha, W. T.; Huebotter, P. R. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 28p. AT.

GCFR Demo Plant structural reactivity feedback effects, i.e., reactivity caused by radial displacement of fuel during the approach to full power/flow ratio, have been calculated at ANL using methods developed for similar LMFBR analyses. The thermal-hydraulic analysis performed to characterize trans-duct temperature gradients included the conservative (for this purpose) assumption of slug flow (i.e., no intra-assembly coolant mixing to mitigate thermal bowing). Two cases representing a virgin core (straight ducts) were analyzed to check computational methods and have a basis for comparison with published General Atomic results. Five additional cases representing hypothetical pre-bowing (from swelling effects) and various radial-boundary rigidities were analyzed to search for an upper limit of positive structural reactivity effects in this free unrestrained core. It is believed that this "bounding approach" has succeeded in defining a tolerable upper limit of hypothetical positive feedback, and more rigorous analyses are of marginal priority. (auth)

18844 (CONF-740807-P1, pp 151-165) ADSORPTION OF KRYPTON FROM HELIUM BY LOW TEMPERATURE CHARCOAL. Cooper, M. H.; Simmons, C. R.; Taylor, G. R. (Westinghouse Electric Corp., Madison, PA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Adsorption of krypton from helium by charcoal at temperatures from -100°C to -140°C was experimentally investigated to verify adsorption system design methods and to determine effects of regeneration for the Gas Purification System of the Liquid-Metal Fast Breeder Reactor. Helium with two krypton concentrations, traced by krypton-85 at 0.0044 mu Ci/cm^3, was passed through a 1/2-inch diameter, three-inch long trap packed with coconut charcoal. Breakthrough curves were measured by continuously recording the activity of the effluent gas using a sampler with a krypton-85 detection limit of about 5 x 10^{-7} mu Ci/cm^3. Experimental breakthrough curves with continuous feed for both concentrations and for superficial gas velocities of 5 to 28 cm/sec were closely fitted when the pore diffusion term was omitted from the Anzelius linear equilibrium adsorption model indicating that the adsorption process for this system was controlled by gas phase mass transport kinetics. Adsorption capacities determined in these experiments at -140°C agreed closely with published data. A discontinuity, however, was observed in the krypton adsorption coefficient between -100 and -120°C. This discontinuity may be caused by capillary condensation of krypton in the charcoal pores. Breakthrough times for pulse experiments at 400 ppM (vol.) krypton concentration were several times greater than breakthrough for continuous feed experiments at equivalent conditions. The differences in breakthrough times indicate that the adsorption isotherms are non-linear in this concentration range. Regeneration experiments showed that purging with helium at room temperature for 16 hours was inadequate, since lower breakthrough times were obtained after this treatment. Regeneration under vacuum at 100°C or 200°C for 16 hours resulted in satisfactory regeneration (i.e., no reduction in breakthrough times occurred in subsequent runs). (auth)

18845 (CONF-750617-4) THERMAL RATCHETTING IN PIPES SUBJECTED TO INTERMITTENT THERMAL DOWNSHOCKS AT ELEVATED TEMPERATURES. Corum, J. M.; Young, H. C.; Grindell, A. G. (Oak Ridge National Lab., Tenn. (USA)). 1974. 19p. Dep. NTIS $4.00.

From 2nd ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

The results of two thermal ratchetting tests on straight sections of pipe are presented. The pipes, each of which was machined from a well-characterized heat of type 304 stainless steel, were subjected to a series of thermal downshocks on their inner surface, followed by sustained periods under an internal pressure loading at a temperature of 1100°F. Testing was carried out in a special sodium test facility built for the purpose, and the outer surface strain histories were measured using high-temperature capacitive strain gages. The circumferential strain responses, which typify the inelastic behaviors, are presented. 7 references. (auth)

18846 (COO-2004-1) LMFBR LARGE VALVE TECHNOLOGY DEVELOPMENT. Concept Selection Summary. Topical Report CR-0040. (Crane U. S. A., Chicago, Ill. Research and Development Div.). Jun 1969. Contract AT(11-1)-2004. 74p. Dep. NTIS $6.75.

The primary design considerations pertinent to LMFBR large valve development are presented. The effects of high-temperature sodium service are detailed as well as the primary functional requirements for isolation, flow control, and check valves. Upon the stated criteria, eighteen design concepts, three for each functional valve type for each of two external environments, have been developed. Each of the design concepts will be expanded into preliminary designs and analyzed in depth under later program tasks. (auth)

18847 (COO-2250-14) MIT LMFBR BLANKET RESEARCH PROJECT, JANUARY 1, 1975–MARCH 31, 1975. Driscoll, M. J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 1975. Contract AT(11-1)-2250. 8p. Dep. NTIS $4.00.

Progress in the experimental and theoretical investigation of LMFBR breeding blanket design parameters is reported. Some data from radial blanket fuel management studies are presented. (JWR)

18848 (JAERI-M-5867) EXPERIMENT AND ANALYSIS OF B_4C SIMULATING CONTROL ROD ON FCA V-3 ASSEMBLY, (1).

Neutron Source Multiplication Method. Mizoo, N.; Maekawa, H.; Iijima, T.; Matsuno, Y.; Kobayashi, K. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 84p. INIS. NTIS (US Sales Only) $7.25.

Reactivity worths of the simulated B_4C control rods have been measured and analysed on the FCA V-3 Assembly which was constructed as the engineering mock-up for the Experimental Fast Reactor "JOYO". Assembly V-3 differs from JOYO in the blanket composition and the simulated control rod is ½ size. The range of ratios of the theoretical to experimental values (C/E) was determined. The reactivity worth of the B_4C control rod is obtained by measurement of the subcriticality of the system containing the control rod. The neutron source multiplication method was employed. The multigroup diffusion approximation was used for calculations for the core and blanket, and the collision probability method was used for the effective cross sections of the simulated B_4C control rod region. The cross section set used in the calculation is JAERI FAST Version 2. The lowest limit of the subcriticality of the system is −6% δk/k and the C/E ranges from 1.00 to 1.03. (auth)

18849 (JAERI-M-5890) MEASUREMENT AND ANALYSIS OF DENSITY COEFFICIENT ON FCA-V. Iijima, T.; Hirota, J.; Shirakata, K.; Fujisaki, S.; Kobayashi, K. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 28p. (In Japanese). INIS. NTIS (US Sales Only) $4.50.

The results of density coefficient measurements performed on FCA-V mockups of the Experimental Fast Reactor "JOYO" are summarized. Theoretical aspects of the Density Coefficient Method are given, and applicability of the method to prediction of the criticality is examined for a core of different composition. It is revealed that the effect of higher plutonium isotopes, especially ^{241}Pu, is important in the prediction of the criticality of "JOYO". (auth)

18850 (JAPFNR-187) EXPERIMENT ON PRESSURE WAVE PROPAGATION. I. The Result of Experiment on Branches and Bends. Hishida, M.; Hori, M. (Japan Atomic Energy Research Inst., Tokyo; Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). Nov 1974. 77p. (N−951-74-09). Dep. NTIS (US Sales Only) $5.45.

Work performed under United States−Japanese fast reactor exchange program.

For the purpose of studying pressure wave propagation in the secondary loop of the prototype Fast Reactor MONJU, branches and bends are studied for on pressure wave propagation with respect to 2 kinds each of model specimens. Water was used as the medium for the pressure wave propagation. An input wave in which pulse rising time of pressure wave is about 1.5 msec and wave height is about 0.5 kg/cm^2 - 6.0 kg/cm^2 was used. The findings obtained as a result of the experiments are included. (auth)

18851 (ORNL-tr-2994) BREEDING GAINS OF SODIUM-COOLED OXIDE-FUELED FAST REACTORS. Mougniot, J. C.; Barre, J. Y.; Clauzon, P.; Ciacometti, C.; Neviere, G.; Ravier, J.; Sichard, B. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France)). 1975. Translation of French Report. (CONF-750411-6). 18p. Dep. NTIS $4.00.

Calculated values are presented for the breeding gains of French fast reactors, and the experimental uncertainties are discussed. The effect of various choices of planning on the breeding gains is next analyzed within the framework of classical concepts. In the final part, a new concept involving "heterogeneous cores" with a single enrichment zone is presented. This concept permits a significant improvement in the breeding gain and doubling time of fast reactors. (auth)

18852 (RD/B/N-3272) REFLECTION OF ULTRASONIC WAVES FROM SPHERICAL OBSTACLES. Johnson, D. M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1975. 21 p. Dep. NTIS (US Sales Only) $4.25.

A proposed in-core technique for the measurement of void fractions in the sodium coolant of fast reactors is based on the reflection of broadband ultrasonic pulses. Accurate calibration of the equipment with typical voids has inherent problems and will only be possible by comparing the signals from standard spherical reflectors. The object of this study is initially to establish whether the amplitude (and possibly phase) of the reflected pulse is singularly related to the physical dimensions of the reflector. This relationship will then be studied and the difference between reflection from solid spheres of various properties and collapsible bubbles will be examined. If a large correction is necessary, then the reflection characteristics from bubbles must be predicted accurately, as the measured results already require considerable modification by detector response functions. (auth)

18853 (WARD-CR-3045-8) CORE RESTRAINT DEVELOPMENT. Quarterly Progress Report For Period Ending February 28, 1975. Thompson, D. C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). May 1975. Contract E(11-1)-3045. 30p. AT.

The 121-assembly tests at ARD are 40 percent complete. Data are being transmitted to LMFBR contractors on a regular basis for use in specifying CRBRP design criteria and calibration of structural codes under development. Withdrawal force tests on single assemblies under simulated three-dimensional conditions are being carried out at HEDL. This activity, directed by GE, is carrying out an investigation of the effect of nosepiece clearance on overall withdrawal forces. PARABOW, NUBOW 3-D (Inelastic), and CORTAC development and calibration effort at ANL are nearing completion. PARABOW is now being run at Westinghouse. Plans are being made for full-core tests scheduled for the fall of 1975 at Westinghouse. Hardware for simulated fuel assemblies and facility modification is being designed and placed on order. Eight additional instrumented assemblies will be provided by GE for full-core tests. (auth)

18854 (WARD-RB-3045-8) RADIAL BLANKET DESIGN AND DEVELOPMENT. Quarterly Progress Report for Period Ending November 30, 1974. Bishop, E. C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jun 1975. Contract E(11-1)-3045. 58p. AT.

Progress in the design and development of LMFBR radial blankets during the quarter is reported. The research included heat transfer testing, irradiation testing, mechanical testing, and flow orificing testing. (JWR)

18855 DEVELOPMENT OF STEAM GENERATOR IN LIQUID METAL FAST BREEDER REACTOR. Kawara, M.; Yamaki, H. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works); Sakurama, N.; Kato, Y.; Suzuoki, A. Hitachi Hyoron; 56: No. 9, 907-912(Sep 1974). (In Japanese).

Worldwide development of the Liquid Metal Fast Breeder Reactor (LMFBR) is underway. The steam generator involves many design and engineering problems because of its exposure to high temperature sodium and the potential hazard of sodium-water reaction. Hitachi, Ltd. has been conducting research and development programs on steam generators for ten years. Some of the results of the research and development are described, including decarburization and creep of stabilized and non-stabilized ferritic steels (2¼ Cr−1 Mo), static and dynamic heat transfer characteristics in a helically coiled tube, and wastage rate and safety analyses on the sodium-water reaction. (auth)

18856 THE BRITISH 250 MW EXPERIMENTAL FAST BREEDER. Arch. Energiewirtsch.; 29: No. 4, 375-383(Apr 1975). (In German).

Translated from: Heating and Air Conditioning (Dec 1971) v. 44(517) p. 20-24.

The aims of the DERE (Dounreay Experimental Reactor Establishment) concerning the development of fast reactors are presented along with a report on operational experience with the DFR. This experience provided the basis for the PFR reactor. A description of the present state of development of the PFR is followed by a discussion of the fuel cycle and the general layout of the PFR. Some details are given on the industrial fast breeders still in the design stage. (GE)

18857 MANIPULATION OF THE EQUIPMENT OF THE POWER PLANT PROVIDED WITH THE FAST BREEDER BOR-60 DURING IRRADIATION. Kizin, V. D.; Poljakov, V. I.; Cecotkin, Ju. V.; Kevrolev, V. P.; Levin, L. M.; Rybakov, V. N. Arch. Energiewirtsch.; 29: No. 4, 383-390(Apr 1975). (In German).

Translated from At. Ehnerg. (Dec 1974) v. 37(6) p. 471-474.

An account of experience collected during the 4 years of operation of the BOR-60 reactor and after its shutdown due to defective fuel assemblies is presented. Most of the experience relates to the radiation situation (a) during operation with completely intact and partly defective fuel assemblies,(b) after reactor shutdown, (c) during rearrangement of fuel elements and refueling, and (d) during maintenance work in large structural components. Information is also given on the types of radioactive isotopes in the fallout deposits and their local distribution as well as on the measured radioactivity. (GE)

18858 STUDY ON THE VIBRATION CHARACTERISTICS OF DOUBLE WALL PIPING STRUCTURES. Kawaguchi, O. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Shiraki, K.; Fujita, K.; Iwase, T. Mitsubishi Juko Giho; 11: No. 5, 667-677(Sep 1974). (In Japanese).

It is very important from the viewpoint of aseismic design to make clear the vibration characteristics of piping structures to be installed in nuclear power plants, chemical plants and so forth. The double wall piping structures described are to be installed in

the main and auxiliary coolant systems of the Japanese Fast Breeder Reactor "Monju". The double wall piping structures consist of an inner piping and an outer piping. Sodium coolant flows through the inner piping and preheated inert gas flows through the annulus between the two pipings. In case of sodium leakage through small cracks on the inner piping wall, the outer piping must act as a containment structure. Besides, the inner piping must not be constrained by the outer one, so bellow structures are adopted in part of the outer piping to let them absorb the difference in expansion. Experimental models were made of double wall piping and their mechanical and structural behavior was examined. A mathematical model of the double wall piping was studied, and a computer code which is applicable to the static analysis and analysis of the vibration and earthquake responses was developed. The results of calculation on the experimental models with this computer code showed a good agreement with the experimental results. (auth)

18859 AIR MONITORING TECHNIQUES FOR RADIOACTIVE SODIUM AND FISSION PRODUCTS IN LMFBR. Yoshida, Y.; Naritomi, M.; Murata, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Nippon Genshiryoku Gakkaishi; 16: No. 9, 478-485(Sep 1974). (In Japanese).

The air monitoring system for liquid-metal-cooled fast breeder reactors will for the most part be similar to those for other types of reactor. One particularity, however, is that the main object of air monitoring would be radioactive sodium aerosol mixed with fission products such as radioiodine. A review is presented of studies made on the behavior of sodium aerosol and fission products, particularly radioiodine, in a sodium aerosol produced as a result of sodium leakage from the primary cooling system of an LMFBR and also on the air monitoring techniques available for such air contamination. The cases of other radionuclides and corrosion products are also described. (auth)

18860 FUEL FAILURE DETECTION METHOD. Cohen, P. (to USAEC, Washington, D. C.). German Patent Document 2435424/A/. 6 Mar 1975. 13p. (In German).

A method of detection of small amounts of radioactive iodine in the presence of large amounts of radioactive sodium is claimed. The method can be used for fuel failure detection in a sodium-cooled FBR type reactor. (GE)

18861 SODIUM COOLING OF NUCLEAR REACTORS. Development State of the Sodium Technology and the Significance of Sodium as a Heat Transfer Medium. Kleefeldt, K. VDI (Ver. Dtsch. Ing.) Nachr.; 29: No. 15, 28-29(Apr 1975). (In German).

Since the development of fast breeder reactors, sodium has become an important heat transfer medium. The basic problems of sodium technology (such as chemical interaction with the structural materials, the mechanical, thermal and hydraulic properties of the coolant and the structures as well as the specific instrumentation and treatment of sodium) seem to be recognized and can be coped with, as the long-term operation of several experimental reactors has shown. The reliability of large units can only be proved by long-term operation of these plants. (GE)

Research, Test, and Experimental Reactors

Refer also to abstracts 18496, 18804, and 19113.

18862 (ANL-CT-75-37) EVALUATION OF FLOW-INDUCED VIBRATION PREDICTION TECHNIQUES FOR IN-REACTOR COMPONENTS. Mulcahy, T. M.; Turula, P. (Argonne National Lab., Ill. (USA)). May 1975. Contract W-31-109-Eng-38. 45p. Dep. NTIS $5.25.

Selected in-reactor components of a hydraulic and structural dynamic scale model of the U. S. Energy Research and Development Administration experimental Fast Test Reactor have been studied in an effort to develop and evaluate techniques for predicting vibration behavior of elastic structures exposed to a moving fluid. Existing analysis methods are used to compute the natural frequencies and modal shapes of submerged beam and shell type components. Component response is calculated, assuming as fluid forcing mechanisms both vortex shedding and random excitations characterized by the available hydraulic data. The free and force vibration response predictions are compared with extensive model flow and shaker test data. (auth)

18863 (ANL-CT-75-45) FFTF UPPER PLENUM MIXING STUDIES. Lorenz, J. J.; Carlson, R. D.; Howard, P. A. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 73p. AT.

Experimental testing and analytical modeling of the flow patterns within the upper plenum of FFTF following a reactor scram are described. Two complementary series of tests were conducted at $1/15$ scale where one series simulated the transient with sodium while the other series was conducted with water and brine. A comparison of the data show water and brine to be an effective test mechanism yielding conservative estimates of the thermal transients and to be a valid experimental approach to simulation testing. The effective mixing volume of the upper plenum was observed to vary from 50 to 80% for normal scrams and to be a function of the inlet geometry. By conducting tests with shutdown flowrates of 20, 40, and 60%, it was revealed that the effective mixing volume increases with shutdown flowrate and at 60% shutdown flowrate, the effective volume is 100%. Complete mixing and the absence of stratification were observed for constant flow scrams for all tested inlet geometries for the sodium series and the water-brine series of tests. Two approaches were used in the analytical modeling of upper plenum mixing: a two-dimensional transient code solving the governing differential equations of mass, momentum, and energy throughout the plenum (MIX) and a semi-empirical lump-parameter code (PLENUM-3). (auth)

18864 (CONF-720902-, pp 117-126) VERSATILE SUBCRITICAL FACILITY FOR UNDERGRADUATE NUCLEAR ENGINEERING INSTRUCTION. Gage, S. J.; Draper, E. L.; Bouchey, G. D.; Atkinson, G. D. Jr. Jun 1975.

From national topical meeting on the applications of californium-252; Austin, Texas, USA (11 Sep 1972).

In applications of californium-252. Proceedings of the American Nuclear Society national topical meeting, Austin, Texas, September 11-13, 1972. (Texas Univ., Austin (USA)).

The use of subcritical reactors of TRIGA (or other low-power) reactor fuel driven with intense Cf-252 neutron sources is proposed for undergraduate nuclear engineering laboratory instruction. A typical facility composed of 56-59 TRIGA elements in the usual TRIGA grid is described. Measurements of the subcritical reactivity, neutron multiplication, and gamma radiation field of such an assembly are presented. An estimate that ten or more such assemblies could be formed from used and idle TRIGA fuel is made. The licensing of these facilities is discussed. (auth)

18865 (CONF-740807-P1, pp 166-176) ENGINEERING SCALE TESTS OF AN FFTF FISSION GAS DELAY BED. Kabele, T. J.; Bohringer, A. P. (Westinghouse-Hanford Co., Richland, WA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The dynamic adsorption coefficient of ^{85}Kr on activated charcoal from a nitrogen carrier gas was measured at -80 and -120°C at pressures of zero and 30 psig. The effects of the presence of impurities in the nitrogen carrier gas (1 percent oxygen, and 100 vppm carbon dioxide) on the adsorption coefficient of ^{85}Kr were also measured. The ^{85}Kr adsorption coefficient increased with decreasing temperature, and increased with increasing pressure. The presence of oxygen and carbon dioxide impurities in the nitrogen carrier gas had no discernible effect upon the adsorption coefficient. The adsorption coefficient for ^{85}Kr from nitrogen gas was lower than for adsorption of ^{85}Kr from an argon gas stream. The work concluded a test program which provided design data for the fission gas delay beds which will be installed in the Fast Flux Test Facility (FFTF). (auth)

18866 (CONF-7410123-) THIRD EUROPEAN CONFERENCE OF TRIGA USERS, NEUHERBERG, GERMANY, OCTOBER 29-31, 1974. Papers and Abstracts. (General Atomic Co., San Diego, Calif. (USA)). 1974. vp. (In German and English).

Separate abstracts were prepared for each of the 26 papers included. (JWR)

For abstracts of individual papers see: 16700, 16757, 16771, 18867-18888, and 19165.

18867 (CONF-7410123-, pp 1.1-1.17) RESEARCH REACTOR BER II. Buchholz, H.; Fischer, C. O.; Wasserroth, K. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). 1974. (In German).

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The design parameters of the EBR II, a swimming pool reactor with a thermal power of 5 MW, are outlined. The reactor went critical on Dec. 9, 1973, with the MTR core and on Feb. 14, 1974, with the UZrH core. Reactivity measurements on the UZrH core are reported. The properties, operational behavior, and criticality considerations of the UZrH and MTR core are discussed and com-

pared. Neutron flux density measurements on the UZrH core are reported. Neutron spectral measurements on the radial and tangential beam holes are given for the MTR core. Form factors and thermal charge of the UZrH core are given. (JSR)

18868 (CONF-7410123-, pp 1.18-1.21) OPERATION EXPERIENCE WITH THE TRIGA MARK II REACTOR VIENNA IN THE YEARS 1972 THROUGH 1974. Boeck, H. (Atominstitut, Vienna). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Since the last TRIGA Users Conference in Pavia 1972 the TRIGA reactor Vienna was in operation without any larger undesired shutdown. The integral thermal power production by Sept. 1, 1974, was 3420 MWh. The principal work carried out during the last two years on the reactor system was the installation of a new heat exchanger and primary pump both designed for 1 MW steady state operation. Permission was also obtained from the local authority to withdraw up to 90 m^3/h secondary cooling water from the well. Some troubles were observed with the pulse rod. After nearly 12 years of operation the connection between the piston rod and control rod broke off just below the water surface. Therefore the piston was shot out without withdrawing the pulse rod itself. After locating the trouble the damage was repaired within one day. The SST fuel elements type 110 were received by the end of 1972 for the purpose of power upgrading. All other fuel elements except one are still located in the reactor core and shifted periodically in order to obtain an optimal burnup. A new alarm system was ordered from Hartmann and Braun and is under installation at the moment. In order to facilitate cooperation with the reactor operation personnel and the experimenters in the reactor hall an accurate power indicator has been installed in the reactor hall which allows all experimenters to read the reactor power as accurately as in the control room itself. (auth)

18869 (CONF-7410123-, pp 1.22-1.44) EXPERIENCE IN OPERATION AND MAINTENANCE OF THE TRIGA MARK II REACTOR AT THE UNIVERSITY OF PAVIA. Cambieri, A.; Cingoli, F.; Genova, N.; Meloni, S.; Pinelli, T. (Univ., Pavia, Italy). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Experience in the operation and maintenance of the 250 kW steady state/250 MW pulsed TRIGA Mark II Reactor of the University of Pavia in the past two years is reported. Data for the reactor utilization and of Health Physics activity are also presented. Since the Second European Conference of TRIGA Reactor Users in 1972, reactor operation continued normally. No major troubles occurred during this time except for rotary specimen rack rotation. Maintenance of reactor facilities, including the substitution of the rotary specimen rack with a new one manufactured on-site is described. In June 1974 measurements of fluxes in the thermal column, with most of the graphite elements removed, were carried out in order to install a neutron converter in thermal column. Some results of fluxes and cadmium ratio values are reported. A description of the converter facility set up is given. (auth)

18870 (CONF-7410123-, pp 2.1-2.17) OPERATION, OPERATIONAL EXPERIENCES, AND MEASUREMENTS AT THE TRIGA MAINZ REACTOR. Menke, H. (Univ., Mainz). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In Third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

A survey of the use of the reactor during the last 7 years is given, showing a steady increase in the number of pulse irradiations in connection with the use of fast pneumatic transfer systems. A total of more than 8400 pulses have been performed so far with the first core loading, except the B-ring elements, which were replaced by stainless steel clad fuel elements. Twelve fuel element measurements were made since the startup of the reactor, one element was removed from the core after an elongation of more than 5 mm. A classification of the elongation of the other elements is given. Experiences in the maintenance work of the reactor during the last years are briefly discussed. For pulse experiments with short-lived nuclides, the time schedule of the pulse must be known to determine exactly the time after start of the pulse rod when the sample must be shot out of the reactor. Therefore, time diagrams of pulses after step insertions of reactivity of 1.25, 1.50, 1.75, and 2.00 were measured. The data of these pulses are also compared with calculated values. (auth)

18871 (CONF-7410123-, pp 2.18-2.30) OPERATION AND MAINTENANCE OF THE 250 kW TRIGA MARK II REACTOR AT THE J. STEFAN INSTITUTE, LJUBLJANA, YUGOSLAVIA. Dimic, V.; Mavko, B. (Univ. of Ljubljana, Yugoslavia). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The operational data in the years 1972-1973 and up to October 1974 are presented. A general trend observed in the past two years is a slow aging of the electronic equipment. Problems with the recorder were experienced and a new recorder will be installed at the end of 1974. The other equipment performs without troubles. Because of the substantial elongation of the fuel elements, 5 FLIP fuel elements were inserted. Extensive measurements of the neutron flux distribution were performed. The measurements of power noise of the reactor have shown that the different inlet systems for the cooling water produce different power noise. The diffuser mixes the water very extensively, therefore vibration of the regulating rods is suspected. The diffuser of the inlet system for cooling water was exchanged with the short pipe. (auth)

18872 (CONF-7410123-, pp 2.31-2.37) IMPROVEMENT IN OPERATING CHARACTERISTICS RESULTING FROM THE ADDITION OF FLIP FUEL TO A STANDARD TRIGA CORE. Randall, J. D.; Feltz, D. E.; Godsey, T. A.; Schumacher, R. F. (Texas A and M Univ., College Station). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego Calif. (USA)).

To overcome problems associated with fuel burnup the Nuclear Science Center of Texas A and M University decided to convert from standard TRIGA fuel to FLIP-TRIGA fuel. FLIP fuel, which incorporates erbium as a burnable poison and is enriched to 70 percent in U-235, has a calculated lifetime of 9/MW-years. Due to limited funds a core was designed with a central region of 35 FLIP elements surrounded by 63 standard elements. Calculations indicated that the core excess and neutron fluxes were satisfactory, but no prediction was made of the improvements in core lifetime. The reactivity loss due to burnup for a standard core was measured to be 1.54 cents/MW-day. The addition of 35 FLIP fuel elements has reduced this value to approximately 0.5 cents/MW-day. The incorporation of FLIP fuel has, therefore, increased the lifetime of the core by a factor of three using fuel that is only 20 percent more expensive. The mixed core has other advantages as well. The power coefficient is less, the effect of xenon is less, and the fluxes in experimental facilities are higher. Thus, the mixed core has significant advantages over standard TRIGA fuel. (auth)

18873 (CONF-7410123-, pp 3.1-3.17) POWER TRIGA CALIBRATION BY THERMAL METHOD. Verri, A. (Laboratorio di Fisica Nucleare Applicata Centro Studi Nucleari della Casaccia, Rome). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The object of the present work is an analysis of a procedure allowing an increase in the accuracy of experimental approximation of the thermal power of a TRIGA reactor or, generally, of a swimming pool reactor, recovering the heat losses which have the form: $F(T)$ equals $F_0(T - T_0)$ where F_0 is a constant and T_0 is a temperature, both obtained with experimental methods. (auth)

18874 (CONF-7410123-, pp 3.18-3.24) REACTOR NOISE MEASUREMENTS AT THE FRN. Strube, D. (Forschungsreaktor, Neuherberg, Ger.). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Reactor noise measurements are described which were made at FRN for calibration of low reactor power levels to determine the ratio of delayed neutron fraction to prompt neutron generation time beta/l for different core positions and to investigate control rod vibrations at high power levels. For neutron flux measurements at low power, ionization chambers were used, and at high power Co-SPN-detectors were used. The statistical evaluation of the reactor noise signal was made with the correlator 3721A and the spectrum display 3720A of Hewlett Packard. (auth)

18875 (CONF-7410123-, pp 3.25-3.40) SPACE- AND TIME-DEPENDENCE OF THE GAMMA FIELD IN THE FRN EXPOSURE ROOM. Jentzsch, U. (Gesellschaft fuer Strahlen-und Umweltforschung mbH, Neuherberg, Ger.). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The exposure room is one of the most attractive experimental devices at the FRN reactor. In this room the core is used as a strong source of gamma rays for irradiation experiments, when the reactor is not in operation. The dose rate is a function of space and time. Moreover, the radioactivity of fission products depends on the history of reactor operation. This report gives a summary of measurements performed by Fricke dosimetry as a substandard and an ionization chamber. (auth)

18876 (CONF-7410123-, pp 4.1-4.20) EXPERIENCE WITH TRIGA ALUMINUM-CLAD FUEL ELEMENTS. Copic, M.; Dimic, V.; Ilic, R.; Lipic, L.; Rant, J. (Univ. of Ljubljana, Yugoslavia). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

During 8 years of operation the cumulative heat energy produced in the steady-state TRIGA Mark II 250 kW reactor at Ljubljana reached 4683 MWh. The initial core had Al-clad fuel elements only. The reactivity loss due to the burnup has been compensated by fresh fuel elements with SS-cladding and, lately, by FLIP fuel elements, moving the most irradiated Al-clad fuel elements from B and C rings to the F ring and, lately, to the storage rack. The inspection of the fuel elements during the summer of 1973 revealed excessive elongations of some Al-clad fuel elements, up to 36.8 mm. By the neutronography, performed by indirect methods (In, Dy), and also by direct methods (track detector CA 80-15 B) and by special radiographic procedures on the element, the activity of which decayed sufficiently, it has been demonstrated that the growth is due to the elongation of aluminum cladding only. No growth and/or swelling of the ZrH–U fuel or the graphite plugs has been observed within the accuracy of detection. (auth)

18877 (CONF-7410123-, pp 4.21-4.24) RESULTS OF FUEL ELEMENT CONTROL IN THE HEIDELBERG I TRIGA RESEARCH REACTOR. Krauss, O.; Juenger, D. (Deutsche Krebsforschungszentrum, Heidelberg). 1974. (In German).

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The results of fuel element controls after 52, 61, and 70 MWd of energy released were reported. The fuel element used was element No. 102 with 36 g ^{235}U, a H/Zr ratio of about 1, and an Al cladding. The sharpest distortions were measured in the B1 position and the B2 and B6 positions which lie between the two control rods in the C ring and the central irradiation positions. After 52 MWd the fuel element in the B1 position was so warped that the core and the upper lattice plates had to be removed in order to remove the fuel element. In tests after 70 MWd the fuel element in the B2 position was so warped that neighboring fuel elements had to be removed first. (JSR)

18878 (CONF-7410123-, pp 5.1-5.20) DUAL-CORE TRIGA RESEARCH AND MATERIALS TESTING REACTOR. Chesworth, R. H.; Law, G. C.; Peters, R. H. (General Atomic Co., San Diego, CA). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In Third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

General Atomic Company is under contract from the Romanian Institute for Nuclear Technologies to design, fabricate, and install a research reactor in support of the Romanian National Program for Power Reactor Development. The goal was to select a design concept that provided reasonably high neutron fluxes for long term testing of various fuel-cladding-coolant combinations and also provide high performance pulsing for transient testing of fuel specimens. An effective solution was achieved by the selection of a 14 MW steady-state TRIGA reactor for high flux endurance testing, and an Annular Core Pulsing Reactor (ACPR) for high performance pulsing testing, with both reactors mounted in the same reactor tank and operated independently. The 14 MW steady-state reactor represents a significant extrapolation from existing TRIGA technology so that the design has been supported by considerable analyses and a model testing program. The fuel bundles for the steady-state reactor consist of 25 uranium-zirconium hydride rods clad in stainless steel arranged in a square 5 x 5 array. The steady-state core is provided with downflow cooling at a rate of approximately 275 gpm/bundle. Bundle flow tests will be completed with both heated and unheated models to verify heat transfer, flow distribution, pressure drop, pin vibration, and fretting characteristics of the fuel bundles. The core will be optimized for peak thermal neutron flux and reactivity lifetime within the constraint of a peak fuel meat temperature of 750°C. The operation of the steady-state reactor at a power level of 14 MW will yield peak unperturbed thermal neutron fluxes in the central experiment position of 2.9×10^{14} n/cm^2-sec. The corresponding fast neutron flux (less than 1.125 keV) will be 2.6×10^{14} nv. Although the primary mission of the dual-core reactor facility is power reactor fuel development, additional facilities will be provided for neutron beam physics, neutron radiography (using both direct and indirect techniques) and physics experiments in a large, movable, underwater thermal column. (auth)

18879 (CONF-7410123-, pp 5.21-5.41) SURVEY UPON TWO YEARS OF REACTOR OPERATION AT THE FRN. Rau, G.; Grundler, W.; Weber, J. (Forschungsreaktor, Neuherberg, Ger.). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

This report gives a review of several developments and investigations done at the FRN within the last two years. During and after the startup experiments, a thorough investigation of thermal and fast neutron flux distribution in and around the core took place. When beginning with routine operation, several technical improvements and completions had to be performed. Because of the failing rotary specimen rack as well as by further experimental demands, the irradiation capacity had to be increased by installation of irradiation tubes and corresponding accessories. Also a method for correct power recording has been developed. Finally, several experimental devices were installed. (auth)

18880 (CONF-7410123-, pp 5.42-5.80) ANNULAR CORE PULSING REACTOR FOR NUCLEAR FUEL SAFETY RESEARCH. Pearson, T. B.; Peters, R. H. (General Atomic Co., San Diego, CA). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

A second generation TRIGA Annular Core Pulsing Reactor (ACPR) is under construction by General Atomic Company for the Japanese Atomic Energy Research Institute (JAERI). The reactor will be used in the Nuclear Fuel Safety Research Program to study power reactor fuel rupture mechanisms and threshold values, to determine the mechanical energy behavior associated with fuel rupture, and to evaluate other thermal and hydrodynamic effects of power transients, energy release and temperature. The principal identifying characteristic of the ACPR is the equipment loading tube, which permits the insertion of large experiments into the very center of the annular core. The reactor will be capable of providing a peak neutron fluence in the experiment cavity of 1×10^{15} nvt (greater than 9.1 keV), resulting from a core energy release (prompt burst) of 106 MW-sec, and a reactor peak power of 22,000 MW. Additional experimental flexibility is provided in the test facility itself. A neutron radiography room expands the built-in capability of the facility to inspect the irradiated fuel materials of an experiment. The NSRR experiments will be performed in the large central experiment tube, using specially-designed capsules and loops which can accommodate up to 49 BWR type test fuel pins. Many types of test fuel pins in various conditions will be examined by the NSRR program, such as BWR, PWR and FBR type fuels from the beginning of life to the end of life with and without simulated reactor internal structures. (auth)

18881 (CONF-7410123-, pp 6.1-6.10) DESIGN OF A 250 kW MINI-TRIGA REACTOR. Brenner, L. J.; Peters, R. H. (General Atomic Co., San Diego, CA). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F. R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

General Atomic Company has designed an inexpensive, compact core for a below-ground research reactor capable of up to 250 kW steady-state operation. This mini-TRIGA reactor is a simplified version of the familiar TRIGA Mark I. Created as a tool for small laboratories, the mini-TRIGA is intended for applications such as neutron activation analysis, neutron radiography, isotope production, and training. Like the Mark I, the mini-TRIGA is a below ground, graphite reflected, natural convection cooled reactor utilizing uranium-zirconium-hydride fuel. The principal difference between the mini-TRIGA and the Mark I is the U-235 enrichment in the fuel. In order to reduce core size, uranium enriched to 93 percent has been used instead of the standard 20 percent enrichment. Aluminum cladding is used for mini-TRIGA

elements instead of stainless steel in order to reduce parasitic neutron capture and thus further reduce core size. A standard seventeen-element core results from these features which provides a thermal neutron flux of approximately 8.7 x 10^{12} n/cm^2-sec at 250 kW in the central thimble. The standard instrumentation and control system has been greatly simplified for the mini-TRIGA. Included in the mini-TRIGA instrumentation package are a wide range log power instrument with period and safety channel and a multi-range linear power channel. The rod control chassis includes one rod position indicator with a selector switch, magnet power supply, annunciators, and scram switches. Experimental facilities available include an in-core thimble and an optional pneumatic transfer system and rotary specimen rack. (auth)

18882 (CONF-7410123-, pp 6.11-6.21) ULTRAFAST TRANSPORTATION SYSTEM FOR PULSED RADIATION PLANTS. Kreiner, H. J. (Forschungsreaktor, Neuherberg, Ger.). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

For investigations of short-lived nuclides, an ultrafast transfer system was developed and installed at the TRIGA Mark III–Reactor FRN. The system works automatically and is synchronized with the reactor pulse. The time between the end of neutron irradiation and start of measurement is less than 45 ms. Another specific characteristic of the equipment is the separation of sample and transfer-capsule and the stability of transfer time (less than or equal to +-1 percent). After experiments with a test model the equipment was built into a radial beam tube of the FRN and first measurements with short-lived nuclides have already proved the reliability of the apparatus. (auth)

18883 (CONF-7410123-, pp 6.22-6.30) EURACOS II FACILITY IN THE MODIFIED THERMAL COLUMN OF THE TRIGA MARK II REACTOR AT THE UNIVERSITY OF PAVIA LENA LABORATORY. Perlini, G. (CCR-EURATOM, Ispra, Italy); Nicks, R.; Cambieri, A.; Cingoli, F.; Pinelli, T. 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European Conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The EURACOS II (Enriched URAnium COnverter Source) project forsees the installation of an U–Al alloy converter plate at the end of the thermal column in the Pavia University LENA reactor. The incident thermal flux on the 5 Kg of ^{235}U generates a fast neutron source whose power is 0.4 kW. The fast flux near the center exceeds 10^9 neutrons/cm^2-sec. The fission plate is cooled by a forced air flow of 500 m^3/h; the use of air instead of water reduces to a minimum the initial spectrum deformation of source neutrons. An irradiation chamber of 3.75 x 1.5 x 1.8 m^3 is placed in front of the source and contains the mock-up under investigation. The facility is principally intended for benchmark-and mock-up-experiments in the reactor shielding field, but irradiations to different types and materials not directly related to shielding can be extended. The modification of the TRIGA thermal column, the characteristics of the EURACOS II facility, and the experiments now in preparation are described. The source intensity allows the study of neutron attenuation factor of 10^5 for fast, and 10^8 for thermal neutrons. The neutron spectra are investigated with the sandwich technique in the epithermal range, and with threshold detectors, organic and telescopic spectrometers in the fast energy range. (auth)

18884 (CONF-7410123-, pp 6.31-6.40) IRRADIATION FACILITIES AND THE WATER-POWERED RABBIT TUBE SYSTEM AT THE HEIDELBERG II TRIGA. Krauss, O.; Lorenz, W. J.; Maier-Borst, W.; Ostertag, H. (Deutsche Krebsforschungszentrum, Heidelberg). 1974. (In German).

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The water-operated rabbit tube system with an open irradiation carousel and with special in-core irradiation positions is described. The scheme for the in-core irradiations and the procedures followed are reported. The system is simple and serviceable. Other advantages are tabulated. (JSR)

18885 (CONF-7410123-, pp 7.17-7.36) NEW RESEARCH FACILITIES AT THE FIR-1 REACTOR. Poeyry, H. (Technical Research Centre of Finland, Otaniemi). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Since the rejection in 1970 of the first cold neutron source installed in the Finnish TRIGA Mark II (FIR-1) several projects have been started along with the construction of a new cold neutron source, to develop improved experimental facilities for the basic neutron research carried out at Otaniemi. Some of the new devices are already in operation but considerable effort is still needed before the research programs planned for these instruments can be initiated in their full extent. Brief accounts are given of the following subjects: the present state of the redesigned cold source using high-pressure hydrogen gas for the neutron moderation, the new double-axis diffractometer and the reverse time-of-flight test facility both controlled by a Super Nova computer, the time-focused high-resolution TOF spectrometer utilizing a curved crystal monochromator with a Fourier chopper operated in the reverse TOF mode, and the new liquid nitrogen irradiation facility positioned in the core of the FIR-1. Some relevant research applications are also mentioned. (auth)

18886 (CONF-7410123-, pp 8.1-8.10) RECENT RESEARCH PROGRAMS AT THE TRIGA MARK II REACTOR IN LJUBLJANA. Najzer, M.; Byrne, A. R.; Dimic, V.; Mavko, B.; Pregl, G.; Rant, J. (Univ. of Ljubljana, Yugoslavia). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Recent developments and new research activities which make use of the TRIGA reactor in Ljubljana are reported. They are spread over a broad range of research fields from nuclear and solid state physics, reactor physics and engineering, neutron radiography, analytical chemistry, medicine and biology, and industrial applications. The following investigations are briefly described: Improvements in the thermal neutron beam facility for nuclear capture studies, a rotating crystal time-of-flight spectrometer and its use for measurements of dynamics of crystal lattices in liquid crystals and ferroelectrics, measurements by the fast neutron spectroscopy and dosimetry group of fission-spectrum averaged activation cross-sections for some threshold detectors; measurements of fast neutron spectra in standard TRIGA seed irradiation facilities and improvements of activation data unfolding program ITER II and its application to unfolding of single crystal fast neutron scintillation spectrometers, a simple nuclear power plant simulator to be used for education of plant personnel; neutron activation analysis falls into two parts: ecological studies of the uptake and distribution of mercury and some other micro-elements, in particular in the Idrija area (mercury mining), and the development of methods for the analysis of trace elements in standard reference materials, biological samples, and high purity materials. (auth)

18887 (CONF-7410123-, pp 8.11-8.30) RESEARCH PROGRAMS AT THE LENA NUCLEAR PLANT IN PAVIA. Brandone, A.; Ganzerli-Valentini, M. T.; Orvini, E.; Stella, R.; Fossati, F.; Pinelli, T. (Univ., Pavia, Italy). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

The research activities in the field of physics and chemistry included radiochemistry and activation analysis, research on chemical bonds, and development of neutron spectrometry systems. (TSS)

18888 (CONF-7410123-, pp 9.1-9.9) RECENT NEUTRON PHYSICAL EXPERIMENTS AT THE TRIGA MARK II REACTOR, VIENNA. Rauch, H.; Zeilinger, A. (Atominstitut, Vienna). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Experiments using polarized neutrons and the recently constructed neutron interferometer are described. Polarized neutrons are used for the investigation of magnetic domains. These measurements are based on the depolarizing action of a ferromagnetic material. A substance extensively investigated is Dy. Here some interesting features were measured. One is the heavy broadening of the AFM-FM phase transition in polycrystalline material. This is an indication of internal stresses which influence the magnetic energy and thus the phase transition via the magnetostrictive effect. Further, two different phase transition points with raising and lowering temperature and a marked time dependence of the neutron depolarization were observed. A Laue type neutron interferometer was successfully tested. In this interferometer two widely separated coherent neutron beams are obtained by diffraction on an ideal Si-crystal. Putting a phase shifting medium within the two beams causes a characteristic intensity variation behind the interferometer. These intensity oscillations could easily be de-

tected using Al and Bi as phase-shifted material. An inhomogenous magnetic field caused a marked reduction of these oscillations. No intensity oscillations could be observed using an unmagnetized Ni-sample as phase shifter. This is a result of inhomogeneous phase shifts because of the random magnetic domain structure of the sample. (auth)

18889 (RT/PROT-(75)5) MEASUREMENTS OF THE GAMMA DOSE IN SOME EXPERIMENTAL FACILITIES OF A TRIGA REACTOR. Roca, V.; Moscati, M.; Scarpa, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Feb 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

Small solid thermoluminescent detectors, consisting of undoped beryllium oxide sintered discs, have been used to carry out a series of measurements of the gamma ray dose rate in two facilities of a TRIGA M. II reactor: the central thimble and the Lazy Susan. The measurements have been performed both during reactor running at full power (1 MW) and with not operating reactor, at various times after a scram. The results have shown the possibility of using such facilities for gamma irradiation to very high doses of small samples, e.g. to study the radiation damage effects. 9 references. (auth)

18890 THE NBSR: THE FIRST FIVE YEARS. Carter, R. S. (National Bureau of Standards, Washington, DC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 5(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18891 POWER FLUCTUATION IN PBF DURING INITIAL POWER ASCENSION. Toole, C. R.; Lussie, W. G. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 5-6(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18892 HEAT EXCHANGER EXPERIENCE AT THE NBSR. Nicklas, J. H.; Raby, T. M. (National Bureau of Standards, Washington, DC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 6(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18893 UTILIZATION OF RESEARCH REACTOR LOOP TO PRODUCE PLANT STEAM. Kendrick, S. H.; Snelson, W. K. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 6-7(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18894 FACILITIES AND PROGRAMS AT THE NBS REACTOR. Bickford, N. A.; Ring, J. H.; Raby, T. M. (National Bureau of Standards, Washington, DC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 7(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18895 FUEL UTILIZATION AT THE NUCLEAR SCIENCE AND TECHNOLOGY FACILITY. Haas, M. N. (State Univ. of New York, Buffalo). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 7-8(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18896 FUEL PLATE TEMPERATURE MEASUREMENTS AT THE NBSR. Frizzell, O. E.; Raby, T. M. (National Bureau of Standards, Washington, DC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 8-9(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

18897 USE OF PROCEDURES IN THE MANAGEMENT OF THE PENN STATE BREAZEALE REACTOR (PSBR). Geisler, G. C.; Levine, S. H.; Totenbier, R. E. (Pennsylvania State Univ., University Park). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 23 (1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

Production and Materials Testing and Processing Reactors

Refer also to abstracts 18866–18872 and 18876.

18898 ENERGY-CHEMICAL NUCLEAR REACTORS. Krasin, A. K.; Salamatov, I. I.; Litvinenko, B. A.; Ananich, P. I.; Kazayan, V. T.; Malimonova, L. M. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 5-8(1975). (In Russian).

Information on the development of the nuclear reactors as sources of radiation for radiation chemistry purposes is presented. It's shown that using chemical reagents as both a moderator and a reflector is most promising when synthesizing organic compounds. In this case the 2500 MW (t) pressurized reactor can produce about 35 MW of radiation power with mean dose rate of absorbed energy of $2 \cdot 10^{19}$ ev/cm^3 · sec. (auth)

Propulsion and Package Reactors

Refer also to abstracts 17802–17805, 17883, 17884, 19136–19139, 19141–19145, and 19181–19192.

18899 (AGC-1963) NUCLEAR ROCKET ENGINE CYCLES. Engineering Discussion. (Aerojet-General Corp., Sacramento, Calif. (USA)). Feb 1961. 23p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

The various propellant feed systems for a nuclear rocket engine are described. The feed systems effects on engine performance, reliability, and cost are discussed. (HDR)

18900 (AGC-2151) DESTRUCT SUBSYSTEM FOR NERVA ENGINE. (Aerojet-General Corp., Azusa, Calif. (USA)). 7 Dec 1961. 45p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

This program is concerned with satisfying two basic NERVA safety requirements: in the event of an accident or malfunction involving the NERVA reactor prior to its operation, then the reactor must be rendered essentially harmless; and the fission products which are generated during operation of the reactor must ultimately be disposed of in a satisfactory fashion. The first, or pre-operation destruction requirement is met if the reactor can be so treated as to prevent a power excursion with the associated release of contaminating fission products on land or in shallow water. Such a power excursion will result if the reactor is plunged into the ocean or if it drops into the tank of liquid hydrogen on the booster rocket. Breakup of the reactor into sub-critical pieces prior to its entry into the highly moderating water or hydrogen environment is one means of preventing the excursion. The second, or post-operation destruction requirement is met if no significant quantity of fission products from the reactor is allowed to reach the ground. One method of accomplishing this would be by fragmenting the reactor into pieces which would be completely consumed by burnup during re-entry. Information available indicates that these requirements can probably be met by two separate high explosive systems. The feasibility of accomplishing the post-operation requirement has not yet, however, been demonstrated. The destruct program outlined is therefore aimed at the development of high-explosive systems. (auth)

18901 (AGC-2223) GENERATION-I SIMULATION OF THE HEATED BLEED ENGINE. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 262p. Dep. NTIS $16.25.

Declassified 11 Sep 1973.

A description of the Generation-I Engine Simulator, and the analog-computer circuit for reactor simulation, is presented. The results of the analyses of the computer-control system for achieving simulated nuclear engine characteristics are also incorporated. The test runs and test results are extensively described including an analysis of the data. (auth)

18902 (AGC-2333) RADIATION EFFECTS PROGRAM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1962. 89p. Dep. NTIS $7.50.

Declassified 10 Sep 1973.

The development of the NERVA nuclear rocket engine makes it necessary to accommodate in the design and development stages for the presence of the nuclear reactor. The reactor, during operation and subsequent to operation, imposes a flux of neutron and gamma radiation whose effects, if not accounted for in design, could seriously compromise the operation of the engine. These effects have been recognized and studies have been conducted to determine the best way, both economically and technically, for accounting in the overall engine development program for this environment. To date, the study and analysis program has encompassed the following factors: General classification of the radiation effects on the various engine components. Analysis and evaluation of the available literature on the effects of radiation on materials of construction and a tentative selection of materials to be used. A survey of the facilities that may be utilized for subjecting NERVA hardware components to the anticipated gamma and neutron fluxes. A special test reactor

and test facility to duplicate NERVA fluxes and permit full-scale engine system testing have been designed. Finally, the formulation of a program for determining in detail the effects of nuclear radiation on the NERVA engine and a plan to account for these effects in design, and experimental plans to demonstrate the adequacy of component and system design have been accomplished. The purpose of the Radiation Effects Program is to assure that the design and performance of the components that comprise the NERVA engine are compatible with the levels of radiation to which they will be subjected during actual operation. (auth)

18903 (AGC-2584) OPERATIONAL REQUIREMENTS FOR RADIOACTIVE MATERIALS HANDLING, DECONTAMINATION, AND STORAGE COMPLEX AT NRDS. (Aerojet-General Corp., Azusa, Calif. (USA)). Jun 1963. 97p. Dep. NTIS $8.00.

Declassified 11 Sep 1973.

The operational requirements for the NERVA Engine Radioactive Materials Handling, Decontamination and Storage Complex are defined. The required complex will provide facilities for handling, decontaminating, storage, and otherwise disposing of radioactive materials generated by the NERVA Program. The requirements are limited to the NERVA Program and do not anticipate growth potential or other in-progress or planned programs such as Kiwi, Phoebus, and Rift. The categories covered include metal or engine parts, core components, waste products, tools and equipment, and clothing and protective gear. Functional requirements, not to be confused with operational or facility requirements, are presented for each category and include materials flow, materials handling, decontamination, storage and disposal, packaging, and shipment. Summary data have been supplied which indicate the quantities, sizes, and specific types of materials and the expected rates at which these will be received. Radiation levels are presented for parts, based upon three full power operations of an engine within a period of a month. The data and functional requirements have been evaluated and preliminary operational requirements developed to meet the needs of NERVA testing and post-operative examinations. These include the capability, location, shielding, handling, radiation monitoring, utilities, and area control requirements for specified areas including complete engine storage, recoverable fuel storage, high and low activity recoverable metal parts storage, parts, solid wastes, and scrip disposal, liquid wastes disposal, and decontamination. Certain support areas and functions have also been analyzed including storage and disposal area support facility, contaminated materials packaging capability, radioactive materials shipping and receiving area, laboratory facilities, and special process areas. (auth)

18904 (AI-AEC-Memo-12364(Rev.)) HYDROGEN RETENTION OF SNAP 8 FUEL ELEMENTS CONTAINING NICKLE-PLATED FUEL RODS. Dennison, W. F.; Nummelin, J. L. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Feb 1968. 40p. Dep. NTIS $5.00.

Declassified 4 Oct 1972.

Fuel elements containing nickel-plated fuel were subjected to permeation tests, thermal cycle tests, diffusion tests and endurance tests. Hydrogen losses of endurance tested elements with nickel-plated fuel were low, when compared to losses of other prototype S8DR elements. During testing, the nickel diffused into the fuel to varying degrees. The diffusion appeared to be a function of the metallurgical bond obtained between the nickel and the fuel during plating. Considering the problems of nickel diffusion and bonding, it appears that a substantial developmental effort would be required to demonstrate feasibility of adopting the nickel-plated fuel concept. (5 references) (auth)

18905 (FZK-344) NERVA IRRADIATION PROGRAM. ASTR In-Pile-Tube Test 1 Pressure Transducers (Test 23/R512A). Lewis, J. H.; Kunselman, J. S. (General Dynamics Corp., Fort Worth, Tex. (USA). Convair Aerospace Div.). 26 Feb 1968. 91p. Dep. NTIS $7.75.

Strain-gage-type pressure transducers for use on the NERVA engine were evaluated as a function of nuclear heating rate. The irradiation was performed in the in-pile tube of the Aerospace Systems Test Reactor at power levels of from 1.3 to 9.9 MW; the corresponding heating rates (at the point of maximum flux) were 0.36 to 2.76 W/g(C). The test items consisted of four active transducers, two transducers with internally mounted thermocouples, two cables with internally mounted thermocouples, and four cables wired to three dummy bridges located in the control room. The primary data were transducer output voltages, transducer bridge resistances, cable-insulation resistances, and temperatures. At each heating rate, the active transducers were operated at applied pressures of 0, 250, 500, and 750 psig. All of the transducers functioned throughout the test; however, changes in response were observed. During the irradiation, transducer outputs experienced fluctuations greater than observed in pre- and post-irradiation measurements. Following an initial decrease in output at the lower heating rates, each of the transducers then showed an increase in output voltage at the higher heating rates and higher temperatures. Linearity of the transducers was affected little, if any, by the irradiation. Input and output resistances of the bridges generally increased by a few ohms. Cable insulation resistances, which initially were in the 100- to 200-megohm range, dropped to around 1 to 5 megohms at the highest reactor power level. (auth)

18906 (FZK-360) EVALUATION OF CRYOGENIC INSULATION MATERIALS AND COMPOSITES FOR USE IN NUCLEAR RADIATION ENVIRONMENTS. Materials Test and Propellant Heating Test. Quarterly Progress Report, 1 May–31 July 1968. Kerlin, E. E.; Elliott, R. A.; Crabtree, R. D. (General Dynamics Corp., Fort Worth, Tex. (USA). Convair Aerospace Div.). 15 Sep 1968. 50p. Dep. NTIS $5.50.

Experiments to study the combined effects of radiation, cryogenic temperatures, and acoustic noise on certain reactor materials (thermal insulation, valve seals, and various sensors and transducers) are under way. Also, an elaborate system is being built to investigate problems connected with the storage of hydrogen propellant (radiation effects, stratification and destratification equipment, baffles, thermodynamics, radiation heating, etc. The system being built for this experiment is described in detail. (LTN)

18907 (FZK-381) NERVA IRRADIATION PROGRAM. GTR 20C Combined Effects of Reactor Radiation and Cryogenic Temperature on NERVA Structural Materials. McDaniel, R. H.; Laney, W. M.; Warwick, J. E.; Wattier, J. B.; Bell, J. R. (General Dynamics Corp., Fort Worth, Tex. (USA). Convair Aerospace Div.). May 1971. 210p. Dep. NTIS $13.25.

Test specimens fabricated from selected structural materials that are candidates for certain NERVA applications were irradiated using the GTR reactor to fast-neutron fluences in the range from 3×10^{17} to 1×10^{19} (E > 1 MeV) at cryogenic temperature (140°R). The specimens were submerged in LN_2 throughout the irradiation and maintained in LN_2 until they were tested to fracture, removed for annealing studies, or tested at temperatures above 140°R. Materials evaluated for ANSC were Ti 5Al 2.5 Sn ELI, Inconel 718, Aluminum 7039-T63, A286 steel, Hastelloy X, and AISI 347 steel. Tensile tests were performed on all of the materials and fracture toughness tests were performed on the titanium alloy, Inconel 718, and aluminum. Materials evaluated for WANL were A286 steel, Inconel 718 (sheet, springs, and tube specimens), beryllium, Copper-Boron-10, and BATH. Tensile tests were performed on all of the materials and fracture toughness tests were performed on beryllium. (auth)

18908 (LA–3341) QUARTERLY STATUS REPORT OF LASL ROVER PROGRAM FOR PERIOD ENDING MAY 31, 1965. (Los Alamos Scientific Lab., N. Mex. (USA). Jun 1965. Contract W-7405-ENG-36. 134p. Dep. NTIS $9.75.

Declassified 28 Aug 1973.

Results supporting KIWI and PHOEBUS reactors are reported. Analysis of KIWI-B4E-301 data is nearly complete. Measurements of radiation were made from the reactor on the test car after the test, from the test pad after reactor removal and at points 600-1000 ft away. PHOEBUS-1A reactor is described and progress in fabrication reported. Design and predicted performance analyses are listed. PHOEBUS-1B and PHOEBUS-2A designs are discussed. Test facility modifications are detailed. Fuel element development, fabrication and testing results are discussed. The KIWI-TNT test results are reviewed and compared with high explosives. (LTN)

18909 (LA–5133) LASL ROVER PROGRAM. Quarterly Progress Report for the Period Ending November 30, 1972. Skoberne, F. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Jan 1973. Contract W-7405-ENG-36. 74p. Dep. NTIS $6.75.

Declassified 27 Nov 1973.

Progress made in the Rover Program at the Los Alamos Scientific Laboratory is reported. Major efforts centered on the disassembly of Nuclear Furnace 1 and on postmortem inspection of its components; on further development of carbide-graphite composite materials; on carbide fuel and carbide component research; and on insulator development. Other areas reported include NRDS activities, nondestructive testing, and irradiation studies. (auth)

18910 (NAA-SR-Memo-7217) COMPATIBILITY STUDIES OF SOME SNAP 2/10A FUEL ELEMENT MATERIALS. Lundberg, L. B. Atomics International Div., Canoga Park, Calif. (USA)). 13 Mar 1962. 14p. Dep. NTIS $4.00.

Pieces of beryllium, chrome-plated beryllium and beryllium plasma-arc-coated with alumina (Al_2O_3), beryllia (BeO), zirconia

(ZrO_2) and thoria (ThO_2) were placed in contact with Solaramic coating, S14-35A, which had been applied to a chromized Hastelloy N substrate and tested for 1000 hours at 1300°F in a hydrogen atmosphere. Visual observations (macro and micro) indicated that all the flame sprayed coatings were compatible with Solaramic and acted to prevent reaction between the beryllium and the Solaramic. Beryllium also appeared to be compatible with Solaramic although previous tests had indicated slight reaction between these two materials. Due to "wrinkling" of the ceramic, the compatibility of Solaramic and chromium plate applied to beryllium is somewhat questionable. 5 references. (auth)

18911 (NAA-SR-Memo-7258) LIQUID METAL PUMP POWERED BY LEAD TELLURIDE THERMOELECTRIC. Davis, K. A. (Atomics International Div., Canoga Park, Calif. (USA)). 2 Apr 1962. 25p. Dep. NTIS $4.25.

Declassified 30 May 1973.

A liquid metal, dc conduction pump powered by an integrally mounted lead telluride thermoelectric generator was designed, constructed and tested. One thousand hours of operation was obtained under SNAP 10A conditions in a vacuum environment. The tests demonstrate the feasibility of such a pump along with the advantages and disadvantages of the selected design. Design criteria, fabrication techniques, test data and an overall analysis of the design are presented. 3 references. (auth)

18912 (NAA-SR-Memo-7286(Rev.)) ACCEPTANCE TEST FACILITY SAFEGUARDS REPORT. Soske, P. L.; Ostenso, A. S.; Kamensky, F. J. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Oct 1962. Contract AT(11-1)-GEN-8. 128p. Dep. NTIS $9.50.

The purpose of this report is to describe the operation of the Acceptance Test Facility (ATF) and testing of SNAP 10A Auxiliary Power Units (APU) in the facility. A hazards analysis of the facility is included with a discussion of maximum credible accidents and consequences. The Acceptance Test program is presented along with those tests procedures associated with the reactor operation. This report covers only the tests and operations to be conducted with SNAP 10A systems; acceptance tests of SNAP 2 and 8 systems, which will also be conducted in this facility, will be presented in an addendum to be published at a later date. A separate operation manual, presenting descriptions and detailed test procedures, will be issued prior to operation of the facility. (auth)

18913 (NAA-SR-Memo-7289) QUALITY CONTROL PROGRAM FOR SNAP 10A THERMOELECTRIC ELEMENTS. Morris, J. W.; Fitch, S. H. (Atomics International Div., Canoga Park, Calif. (USA)). [nd]. 25p. Dep. NTIS $4.25.

The development and implementation of a complete Quality Control Program for thermoelectric elements is described. The program was set up to aid in the fabrication process development of thermoelectric elements and modules for application to the SNAP (Systems for Nuclear Auxiliary Power) 10A. A brief description and historical sketch of the SNAP 10A is presented. The Quality Control Program of material procurement and quality verification, process control, in-process, and acceptance testing is described in detail. The results of the quality control effort are summarized. (auth)

18914 (NAA-SR-Memo-8147) SNAP 10A POWER SYSTEM SHIPMENT SAFEGUARDS REPORT. Hart, R. S. (ed.). (Atomics International Div., Canoga Park, Calif. (USA)). 9 Sep 1963. Contract AT(11-1)-GEN-8. 90p. Dep. NTIS $7.50.

As a part of the operations required in the joint Atomic Energy Commission–US Air Force SNAP 10A Flight Test Program, it is planned to ship at least two, and possibly three, SNAP 10A power systems by escorted trucks from: (1) the Santa Susana Field Test Laboratories of Atomics International to Vandenberg Air Force Base (VAFB) and (2) VAFB to the Naval Missile Facility, Point Arguello (NMFPA). The safeguards against potential accidents provided during these shipments and an evaluation of the potential consequences of those accidents considered as the maximum credible in each phase are delineated. On the basis of these analyses it is concluded that the shipments, as described, pose no significant hazard to either operating personnel or the public. (19 references) (auth)

18915 (NAA-SR-Memo-8679(Rev.)) SNAP 10A REACTOR DESIGN SUMMARY, REVISION 1. Davis, W. W.; Susnir, J. (eds.). (Atomics International Div., Canoga Park, Calif. (USA)). 26 Oct 1964. 99p. Dep. NTIS $8.00.

Declassified 15 Jun 1973.

A description of the SNAP 10A reactor subsystem is presented. Design details of the principal assemblies which constitute the reactor subsystem are discussed. System behavior for abnormal conditions such as disassembly during reentry, operation in rain-filled craters, and long-term operation in space are included. (13 references) (auth)

18916 (NAA-SR-Memo-9353) TECHNICAL MANUAL: OPERATIONS AND MAINTENANCE. SNAP 10A Prelaunch Test Facility, Building 6527, Vandenberg Air Force Base. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Dec 1964. Contract AT(11-1)-GEN-8. 117p. Dep. NTIS $9.00.

This manual describes the SNAP Prelaunch Test Facility (SPTF) and the procedures utilized in support of the SNAP 10A prelaunch testing program at Vandenberg Air Force Base (VAFB). The SPTF serves as a base of operations for Atomics International personnel assigned to the SNAPSHOT nuclear power unit (NPU) prelaunch testing program conducted at VAFB. The facility is utilized for receiving storage and non-nuclear testing of the SNAP 10A power systems prior to shipment to the launch complex at the Point Arguello Launch Complex No. 2 (PALC-2). The SPTF Operations Manual provides information relative to administration of the AI-VAFB field operations prelaunch testing program and the SPTF. Facility utilization, construction, staffing and related operating procedures are covered in detail. Administrative procedures describe the interim phase beginning with receipt of the NPU components at the facility through preparation for delivery to the launch complex. (auth)

18917 (NAA-SR-Memo-9815) SELF-WELDING IN SPACE: AEROSPACE SAFETY SURVEY. Johnson, H. E. (Atomics International Div., Canoga Park, Calif. (USA)). 3 Apr 1964. 30p. Dep. NTIS $4.50.

Declassified 24 Jul 1974.

The purpose of this TDR is to review the general literature on self-welding and to survey the program at Atomics International in order to evaluate the possibility that self-welding of the beryllium reflector to the 316 stainless steel reactor core will occur while the SNAP system is in operation in space. Seizure of the reflector to the reactor will affect the burnup of the system on reentry into the atmosphere. 29 references. (auth)

18918 (NAA-SR-Memo-11713) COMPARISON OF VOID AND POISON-BACKED CONTROL DRUMS FOR SNAP REACTORS. Simms, R. (Atomics International Div., Canoga Park, Calif. (USA)). 16 Nov 1965. 22p. Dep. NTIS $4.25.

Declassified [1975].

Replacement of void drums by poison-backed drums results in a substantial reduction in shielded envelope in the drums "full-out" configuration. This is particularly important for manned applications, where the shield weight is extremely sensitive to the envelope dimensions. For the 4π shielded manrated SNAP 8 reactor, the use of poison-backed drums results in a decrease of about 1600 pounds in the weight of the shield, or about ten percent of the total reactor-shield weight. In addition, weight penalties are estimated for various design criteria, such as shim capability, shutdown margins and reactivity contingency. The weight penalties for void and poison-backed drums were comparable. However, shimming a reactor with poison-backed drums appears to be more difficult than shimming a reactor with void drums. (auth)

18919 (NAA-SR-Memo-11893) S8ER FUEL FAILURES AS INDICATED BY FISSION PRODUCTS IN NaK AND GAS SAMPLES. Piccot, A. R. (Atomics International Div., Canoga Park, Calif. (USA)). [nd]. 38p. Dep. NTIS $5.00.

Fission products in primary NaK coolant samples, cover gas samples, and vent gas samples are examined and evaluated in an effort to determine when the S8ER fuel elements failed during the S8ER operating history. It is concluded that the fuel elements began to fail in May or June 1964 and that most of the subsequent failures occurred in the June to November 1964 period. Improvements in the procedures, sampling techniques and analysis to permit early detection and identification of fuel failures in S8DS are indicated and recommended. (10 references) (auth)

18920 (NAA-SR-Memo-12087) S8DS FISSION PRODUCT DETECTION SYSTEM. Miller, W. C.; Hallinan, G. J. (Atomics International Div., Canoga Park, Calif. (USA)). [nd]. 27p. Dep. NTIS $4.50.

A design objective for the SNAP 8 Developmental System (S8DS) is to provide an improved failed fuel element detection system. This document reviews the SNAP 8 Experimental Reactor (S8ER) test results and evaluates the various techniques for detection of failed elements. Three systems are recommended for application to the S8DS test: (1) on-line gamma spectrographic analysis of cover gas activity, (2) cover gas sampling for subsequent spectrographic analysis after initial decay, and (3) spectrographic and chemical analysis of NaK samples. (auth)

18921 (NAA-SR-Memo-12099) SNAP 8 SUMMARY, S8ER AND S8DS. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Aug 1966. Contract AT(11-1)-GEN-8. 47p. Dep. NTIS $5.50.

Declassified [1975].

The operational and post-operational results of the SNAP 8 Experimental Reactor (S8ER) are briefly summarized and the inter-

relationship of these results with the SNAP 8 Developmental Reactor (S8DS) design are shown. (auth)

18922 (NAA-SR-Memo-12109) DENSITY CHANGES OF SNAP FUEL DUE TO CHANGES OF H/Zr. Sawicky, W. (Atomics International Div., Canoga Park, Calif. (USA)). 9 Aug 1966. 38p. Dep. NTIS $5.00.

Declassification 9 Oct 1972.

Tests were made to detect and measure any hysteresis of SNAP fuel density with variation of H/Zr. The tests consisted of measuring the density and H/Zr of a number of fuel samples (normal U), adjusting the H/Zr to a different value, and measuring the density at this new H/Zr. Density values were compared to theoretical values. The distribution of the measured density values for the various H/Zr compositions above and below the corresponding values of theoretical density appears random. The variations between the values of measured and theoretical density correspond closely to the variations found for fuel rods immediately after manufacture. (auth)

18923 (NAA-SR-Memo-12180) EXTENSION OF THE NAA 116 POST-IRRADIATION EXAMINATION. Krupp, W. E. (Atomics International Div., Canoga Park, Calif. (USA)). 3 Oct 1966. 18p. Dep. NTIS $4.00.

Declassified 22 May 1973.

Post-irradiation metallographic examination of 116-1 and 116-2 fuel material revealed phases expected based on the hydrogen analysis results, limited microcracking at the edges of all samples. Annealing of high N_H fuel material at 1600°F for 150 hr yielded density changes ranging from −0.75% to +0.72%, indicating that delta phase fuel is resistant to swelling induced by annealing. Annealing of low N_H fuel material at 1500 and 1600°F for 75 hr yielded density changes ranging from −6.75% to −24.01%, indicating that delta plus beta phase fuel is susceptible to swelling induced by annealing. (auth)

18924 (NAA-SR-Memo-12210) SNAP 8 EXPERIMENTAL REACTOR FUEL ELEMENT BEHAVIOR: ATOMIC INTERNATIONAL TASK FORCE REVIEW. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Nov 1966. Contract AT(11-1)-GEN-8. 74p. Dep. NTIS $6.75.

Declassified [1975].

The Task Force scope was to review, evaluate, and make recommendations on Atomics International postirradiation examination of SNAP 8 Experimental Reactor (S8ER) fuel elements. Emphasis was on density changes, dimensional changes, hydrogen composition, and microstructure. Irradiation conditions were extended well beyond previous experience, on which preliminary correlation was based; so that S8ER element dimensional behavior could not be called anomalous. The primary cause of cladding cracking was fuel swelling. At least some of the swelling was anisotropic. Hydrogen loss from cracked elements was greater than that from intact elements, by a factor of not more than two, suggesting the presence of an effective barrier, formed on the fuel rod in cracked elements. (auth)

18925 (NAA-SR-Memo-12229) SHORT TERM MECHANICAL PROPERTIES OF S8DR FUEL CLADDING AS A FUNCTION OF FABRICATION PROCESSING. Dennison, W. F.; Christensen, T. H. (Atomics International Div., Canoga Park, Calif. (USA)). 10 Jul 1967. 89p. Dep. NTIS $7.50.

Declassified [1975].

A study was conducted to establish the effects of the various cladding tube processing steps upon the short term tensile properties of the S8DR cladding tubing material — 10 mil wall Hastelloy N — Heat 281-4-0143. In addition, the changes in grain size of the tubing, end caps and cup-plugs as a function of processing were determined. The effects of varying certain process parameters were also investigated. A second heat of tubing was also tested, but only at key stages of processing. This heat, #5911, was evaluated in the as drawn 15 mil wall size, and after redrawing to a 10 mil wall. (auth)

18926 (NAA-SR-Memo-12422) ATOMICS INTERNATIONAL CONTRIBUTION TO 24th HIGH TEMPERATURE FUELS COMMITTEE PRELIMINARY INFORMATION. Atkins, D. F. (Atomics International Div., Canoga Park, Calif. (USA)). 3 May 1967. Contract AT(04-3)-701. 43p. Dep. NTIS $5.25.

Information is presented concerning LMFBR cladding program, SNAP fuel cladding, uranium carbide research, metal fuels program, and thermophysical properties of irradiated SNAP fuel. (DCC)

18927 (NAA-SR-Memo-12588) POST-IRRADIATION EXAMINATION OF THE NAA-115-2 IRRADIATION EXPERIMENT. Forrester, R. E. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Nov 1967. 176p. Dep. NTIS $12.00.

Declassified 15 Aug 1974.

The NAA-115-2 was the last of three experiments designed to test and evaluate sub-length SNAP 8 fuel elements. This experiment was irradiated at the Hanford Reactor Facility for approximately 10,000 hours (total at design temperature ~8000 hours) to a thermally calculated fuel burnup ranging from 0.33 to 0.37 Ma/o. Fuel centerline operating temperatures ranged from 1300°F to 1600°F (design values). Upon completion of irradiation, the 12 ft. long assembly was sectioned and shipped to the Atomics International Hot Laboratory for a post-irradiation examination. Examination revealed the following results: (1) Four of the twelve test fuel elements contained longitudinal cracks in the cladding resulting from fuel swelling. (2) Eleven of the twelve fuel rods were broken or cracked to some degree which was a result of test conditions (i.e., reactor scrams) and/or experimental design. (3) Density measurements on the center section of the fuel rods indicated volume increases ranging from 1.38% to 4.65% and showed a volume change profile over the twelve elements corresponding to the volume change profile observed in the NAA-115-1 experiment. (4) Metallographic observations at room temperatures and hydrogen analysis indicated that eleven of the twelve fuel rods experienced phase change to some degree during the test. (5) Burnup analyses by mass spectrometry ranged from 0.30 to 0.33 Ma/o. (6) The performance of the in-fuel Geminol thermocouples was excellent during the test and they are recommended for future experiments of this nature. (auth)

18928 (NTO-M-15037) E/STS 2 AND 3 ACTIVATION GUIDE. Preliminary. Staker, R. G.; Magnusson, A. W.; Powell, A. J.; Vandermeer, D. D.; Limbacher, D. L. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 17 Apr 1967. 70p. Dep. NTIS $6.50.

Various activities shown on the E/STS-2 & 3 activation guide network are described. This represents the initial NTO effort in support of the major E/STS-2 & 3 activation activities. Logic for the conduct of the various activities has been based on ETS-1 activation experience and backup references have been included for similar ETS-1 activities where applicable. It is assumed that actions will be taken to minimize the problems encountered after acceptance, such as rebuilding and/or recleaning systems, and hence minimize the costs (monetary and time) of correcting system deficiencies: Specifications will be prepared in such a manner that the appropriate construction standards are a requirement on the contractor; and construction followup of the contractor's effort will be in sufficient detail to insure that the requirements of the specifications are satisfied. (auth)

18929 (NTO-M-18024) NTO SPECIFICATION FOR WELDING STAINLESS STEEL USING THE TUNGSTEN ARC INERT GAS PROCESS WITH "Y" RINGS. NTO-S-0001, Revision 2. Final Issue. Phillips, M. D. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 28 Jul 1967. 10p. Dep. NTIS $4.00.

18930 (NTO-M-20872) ETS-1 INSTRUMENTATION SYSTEM TEMPERATURE CONVERSION DATA. 101 Point Listings and Plots. Barrick, J.; Arnold, H. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 1968. 158p. Dep. NTIS $11.00.

Plots and listings of instrumentation system outputs as functions of the temperature inputs to resistance thermometer and thermocouple transducers are provided. The instrumentation system outputs are expressed as percent of full scale. Temperature inputs are expressed in degrees Rankine. The title for each plot and listing consists of the signal conditioner mode card type, the transducer curve, and the measurement range in degrees Rankine. The data log lists the mode card and transducer curve for each channel number. Conversion of raw data into engineering unit temperature data requires that the recorder deflections be expressed as a percent of scale. The zero through one hundred per cent calibration steps applied to the recorder establishes the scale. This scaling is in one to one correspondence with the per cent scale of the plots and listings. (auth)

18931 (NTO-R-0071) NRX-A5 INTEGRATED NUCLEAR INSTRUMENTATION SYSTEM. Brooks, E. H. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 6 May 1966. 45p. Dep. NTIS $5.25.

The Integrated Nuclear Instrumentation System (INIS) will demonstrate the ability of a fixed position, car-mounted, detector system and an eight decade electronic system to accurately monitor the NRX-A5 reactor power level, and provide electrical signals proportional to the power level for control purposes. The system will provide fixed power, floating power, and period scram protection. The linear channels will utilize fixed position, water-tank-mounted, ion chambers. The INIS is essential since the NRX-A6 and XE-1 reactor mechanical design does not permit utilization of the existing neutronics system because of the 360° shield surrounding the reactor. INIS consists of four Westinghouse WX-5362 electrically compensated ionization chambers and associated electronics. The ionization chambers are lined with enriched

boron and filled with nitrogen gas to a pressure of approximately 10 cm. of mercury. The outer case is titanium and electrodes are of beryllium to reduce gamma heating. Insulators are made of aluminum oxide. The detectors will be mounted on the privy plug under the reactor dome on the reactor centerline. This location was chosen because the NRX-A6 shield configuration does not permit mounting the detectors on or near the pressure vessel at the reactor mid-plane. (auth)

18932 (NTO-R-0105) TEST REPORT FOR SHOCK/VIBRATION LOADS ON TEST CAR-T7 WITH A DUMMY REACTOR. Smith, T. W. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 24 Feb 1967. 12p. Dep. NTIS $4.00.

The shock/vibration loads imposed on the reactor during transportation to and from Test Cell "C," Test Cell "A," R-MAD and E-MAD were investigated. The test was performed using the T-7 Test Car, Dummy Reactor, Spacer Car, Manned Control Car and L-3 Railroad Transport Systems. Accelerometers were mounted in triaxial configuration on the plug of the car under the propellant line pass-through, on the lower side of the privy roof near the privy plug pass-through, and on top of the simulated reactor. Maximum accelerations in any direction were approximately 0.2G. (auth)

18933 (NTO-R-0106) DUCT COOLANT SYSTEM WATER FLOW TESTS. Duct Experimental Plan I and NES Experimental Plans I, II, III, and IV. Henze, H.; Martins, O. R. (NERVA Test Operations, Jackass Flats, Nev. (USA)). Mar 1967. 77p. Dep. NTIS $7.00.

The DEP-I Tests showed that the exhaust duct will withstand the flow rates required without the occurrence of detrimental vibration, and that flow can be controlled by FCV-32. Flow through the three duct sections was adjusted to meet specified requirements with the exception of Section One, which flows approximately 16% in excess of the specified minimum rate. The first orifice sizing test was run at full flow with all three flow control valves 100% open. Flow rates through Sections One and Three were lower than required and the flow rate through Section Two was higher than required. Severe vibrations were observed visually and attributed to cavitation induced by the reduced backpressure conditions. Increasing the backpressure would have the advantage of suppressing cavitation resulting in a smoother operation. The second test used FCV-32 to establish the required flow of approximately 5576 GPM at FE-56 and FE-57, the flow elements for Section Two. Observed duct vibration was significantly less than in the previous test. It was determined that RSV-296 is sufficient to fill and maintain the NES Duct Coolant System in the full condition. It was also determined that the flow through the secondary duct exit cooling system was inadequate with flow rates of approximately 650 GPM being recorded and a minimum of 800 GPM required. Section One of the NES duct was rebalanced during this phase and the main flow system is now considered in balance. (auth)

18934 (NTO-R-0110) ETS-1 TEST SUMMARY REPORT, FEP TEST SERIES. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 26 Jun 1967. 186p. Dep. NTIS $12.50.

The purpose of the FEP test series was to check out the functional performance of certain Engine Test Stand-1 (ETS-1) systems; to provide system performance data required to evaluate the capability of the system(s) to support engine testing; and to develop accurate facility prediction models. The FEP test series also provided an important means for training of operator personnel and development of operating procedures. The information summarized has been based primarily on information reported previously in data evaluation memoranda issued following each FEP. A description is presented of the tests performed and their test dates; the system deficiencies identified and corrected; current system status relative to its capability to support engine testing; and the significant system performance data applicable to the current systems. (auth)

18935 (NTO-R-0113) TEST REPORT: ETS-1 DATA ACQUISITION SYSTEM ACCURACY TESTS. Bridenstine, D. E. (NERVA Test Operations, Jackass Flats, Nev. (USA)). [nd]. 66p. Dep. NTIS $6.50.

Tests were conducted at ETS-1 to obtain data necessary to assess the accuracy of the ETS-1 Data Acquisition System. The tests were conducted in accordance with an approved test procedure. All tests specified were conducted except the Analog Zero Suppressed System tests and the LVDT System tests. All tests were completed satisfactorily with no major system malfunctions or deviations from the test procedure. All deviations and data abnormalities are listed. All changes to the procedure were documented and incorporated in the test procedure. (auth)

18936 (NTO-R-0131) ETS-1 TEST REPORT FOR ETC HELIUM PURGE SYSTEM DIFFUSOR CHECKOUT. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 7 Dec 1967. 71p. Dep. NTIS $6.75.

The results of an evaluation of the data acquired during the ETC Helium Purge System Diffusor Checkout Test are presented. The purpose of the ETC Helium Purge System diffusor is to minimize the interaction between the exiting purge gas and ETC enclosure/engine. This is accomplished by introducing the purge gas through a diffusor which distributes the gas through 68 2-inch-diameter holes. Interaction between purge flow and the ETC/engine is minimized by optimized hole locations. The primary test objective was to verify the structural integrity of the diffusor under conditions equivalent to GHe flowrates of 15, 30, 45 and 60 pps. A secondary objective was to perform various cross-correlation tests to check out the NRO cross-correlation data analysis process. (auth)

18937 (NTO-R-0159) CRYOTRAP CHECKOUT TEST REPORT. Brandt, H. W. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 18 Oct 1968. 60p. Dep. NTIS $6.00.

The cryotrap was designed to remove any trace quantities of compressor oil, water or other impurities from the engine control drum actuator supply gases (GH_2 or GHe). These contaminants might otherwise be condensed in the chilled reactor control drum actuators and block the Servo valve bleed orifices. The results of an evaluation of the data acquired during the checkout of the LN_2 Cryotrap System are presented. The primary objectives were: (1) to determine the operational capabilities and structural integrity of the cryotrap; (2) to demonstrate the valve capability to prevent overpressurization of the control drum actuator bellows. (auth)

18938 (NTO-R-0178) RESULTS OBTAINED ON PEWEE I, EP-III EFFLUENT SAMPLES. Smith, R. A. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 22 Apr 1969. 5p. Dep. NTIS $4.00.

Following PEWEE-I, EP-III, the PAA Health and Safety Department collected approximately 500 particles on six areas that were searched. They were mounted on glass slides for beta counting. The NTO Radiochemistry Group received twenty representative particles for photography, size and weight measurements. Of the nineteen particles examined, fifteen appeared to be ruptured beads or bead fragments, some with attached graphite. The remaining four appeared to be graphite chips, although three showed fission product spectra similiar to those of ruptured beads. Niobium carbide liner materials were not encountered in the set of particles studied. The particulates from PEWEE I, EP-III showed notable differences from those of both NRX-A6 and Phoebus 2A both in general composition and fission product spectra. The particles were generally of a uranium fuel material containing a major portion of the non-migrator fission products, whereas the effluents from the earlier reactors were of a graphite type debris with wide variations in fission product content. (auth)

18939 (RN-NC-0002) NUCLEAR STUDIES OF NERVA ENGINE CLUSTERING. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1965. 50p. Dep. NTIS $5.50.

Declassified 12 Sep 1973.

An evaluation of some of the nuclear and radiation effects of clustering NERVA engines in groups of two and five is presented. Perturbations in reactivity and power density distributions in reactors running at the same power are presented as functions of reactor separation distance. Radiation-induced heating rates in engine components are presented for a typical reactor separation distance. Clustering of NERVA design nuclear rocket engines is concluded to be feasible from a steady-state reactivity and power density interaction point of view; however, clustering can increase component radiation-induced heating rates from a few percent to as much as a factor of 100 for edge-to-edge separations of two feet. Whether or not such heating rates are a problem must still be evaluated on an individual basis for each component. Solutions to problems of overheated components include use of higher temperature materials, increased cooling, and additional radiation shielding. Radiation shielding can be of the shadow shield type, or local shielding around a specific component. Increased propellant tank heating rates resulting from clustering of NERVA engines are of such magnitudes that tank and shielding redesign may be required. Shielding redesign might take the form of increasing attenuation of the present shadow shield, increasing the shadow cone angle, or providing local shielding at the bottom of the tank. (auth)

18940 (RN-S-0012) RADIOACTIVE MATERIALS COMPLEX DESIGN DATA AND STUDIES. (Aerojet-General Corp., Azusa, Calif. (USA)). Feb 1964. 35p. Dep. NTIS $4.75.

Declassified 7 Sep 1973.

Preliminary source data and studies concerning the design of the Radioactive Materials Complex to be located at the Nuclear

Rocket Development Station, Jackass Flats, Nevada are reported. (auth)

18941 (RN-S-0014(Vol. 1)) PROGRAM ACCOMPLISHMENTS, CONTRACT YEAR 1963. Volume I. (Aerojet-General Corp., Azusa, Calif. (USA)). 30 Oct 1963. 299p. Dep. NTIS $18.00.

Declassified 7 Sep 1973.

During the 1963 program plan discussions held in August 1962 the direction to go to the hot bleed cycle resulted in an unscheduled resubmittal of the CY 1963 Program Plan necessitated by extensive changes in subtasks as well as in the support test equipment. In the resubmittal it was assessed that the Mark III TPA could be redesigned to accommodate the additional head rise required, and a presentation was made to SNPO-C which resulted in this becoming the adopted plan. In subsequent meetings and correspondence, however, the design of the Mark IV was made an immediate goal in order to provide increased turbine efficiency. There was general agreement that a major problem in development of the overall TPA was the development of a liquid-hydrogen-cooled bearing and a major objective was to perform a bearing test demonstrating an endurance of one hour. The engine system area has been de-emphasized due to the reactor problems so the emphasis has shifted from obtaining experimental data on the bootstrap phase of the engine startup to more emphasis on pre- and post-test analysis. During the contract year a decision was made to utilize only "prototype hardware" on the CFDTS. Utilization of NRX-A1 cold flow hardware, and a requirement to utilize Mark IV TPA. These decisions had the result and impact of postponing the obtaining of critically important experimental data on the bootstrap start into the end of CY 1964. One of the major objectives in the non-nuclear area was the nozzle development and nozzle end item deliveries. The major effort was devoted to the design incorporating a 347 SS tube bundle cast in an A356 aluminum jacket. Difficulties in fabrication have been experienced but the problems have been defined and corrective actions taken. (auth)

18942 (RN-S-0058) COLD FLOW TEST OF REACTOR CLUSTER AND SUBSTITUTE REACTOR CLUSTER. (Aerojet-General Corp., Azusa, Calif. (USA)). Apr 1964. 82p. Dep. NTIS $7.25.

Declassified 10 Sep 1973.

A test program was conducted to determine whether the cold-flow (with H_2 gas) thermal characteristics of an NRX-type graphite reactor core can be simulated by a metal core during the transient period of the Cold-Flow Development Test System. A substitute full-scale metal core, capable of providing thermal simulation, is described. Transient test data are compared with the results of an analog-computer model transient study for the NERVA engine. Values of experimental heat transfer coefficient and friction factor for the flow of hydrogen through an NRX-type graphite fuel element are given. (auth)

18943 (RN-TDI-0007) NRX/EST NOZZLE AND BLEED PORT QUALIFICATION. Final Test Report (U). Wright, R. B. (Aerojet-General Corp., Sacramento, Calif. (USA)). 24 May 1966. 107p. Dep. NTIS $8.50.

Declassified 10 Sep 1973.

The test results of the chemical simulation test program on hot bleed port nozzle S/N 021 are documented. It is intended to supplement previous report RN-TM-0268 which presented the preliminary data and concluded that the nozzle and hot bleed port had been qualified for the NRX/EST test program. A total of ten tests were made on test stand H-4. Test conditions were essentially as outlined in the test plan. During these tests nozzle simulation conditions were exceeded on all tests except the first test which was primarily a system checkout test. The design value for maximum NRX/EST hot gas tube wall temperature of 2112^0R was exceeded by approximately 100^0R on most tests. One tube was eroded through approximately 1½ inch by .060 in. wide during the second test as a result of a flow obstruction in the tube caused by a broken piece of Kel-F lip seal from the fuel thrust chamber valve. The remaining tubes were carefully inspected and found in acceptable condition. It was determined that the eroded tube would receive adequate cooling after removal of the flow obstruction, and that the test program could be continued without jeopardizing the nozzle. The Hastelloy "C" bleed port was less satisfactory than the 347 CRES bleed port because of: (1) 30 percent lower thermal conductivity; (2) 200^0F lower base metal melting point, and; (3) melting point lowering by eutectic melting of braze fuse alloy. (auth)

18944 (RP-DR-0001) PHOEBUS-2 SIX MONTHS MATERIALS DEVELOPMENT REPORT FOR 15 FEBRUARY–15 AUGUST 1965. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1965. 72p. Dep. NTIS $6.75.

The primary effort was expended on the Phoebus-2 nozzle. In addition, technical engineering data and support were provided to the design activity on related component hardware such as injector and adapter assemblies. Hastelloy X forgings were available for preliminary weld development and the first ring weldment was completed on 3-in.-thick ring forgings. Evaluation of the tensile properties specimens from the same material was also initiated. Accomplishments of the brazing development program include experimental planning, tooling development, experimental channel forming, and jacket grooving. Process specifications are being prepared. (auth)

18945 (SA-696-13-005) RADIOACTIVITY FROM NEUTRON ACTIVATION OF NUCLEAR POWER SYSTEM COMPONENTS IN NASA SPACE STATIONS. Picot, A. R. (Atomics International Div., Canoga Park, Calif. (USA)). 5 Jan 1970. 71p. Dep. NTIS $6.75.

Neutron activation products produced in a space station nuclear power system are determined. The inventories accumulated in the system components and the resulting radiation source strengths are presented for a variety of operating and accident conditions. The important isotopes with respect to direct radiation, inhalation or ingestion hazards are identified. 9 references. (auth)

18946 (TI-652-230-004) SHIELD NUCLEAR DESIGN FOR THE 5-KWE TE SYSTEM. Keshishian, V. (Atomics International Div., Canoga Park, Calif. (USA)). 20 Sep 1972. 15p. Dep. NTIS $4.00.

The nuclear analysis of the 5-kW(e) reactor shield is presented. Calculation methods and optimization techniques used are presented. Borated stainless steel was selected for the gamma ray shield with tungsten alloy as an alternate. The total shield weight was calculated to be 355 lb. (auth)

18947 (TI-652-230-005) LiH SHIELD ANALYSIS. Felton, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 5 Oct 1972. 15p. Dep. NTIS $4.00.

Thermal analyses of the LiH neutron shield are presented. Acceptable temperature profiles are obtained when the shield containment shell is coated with reflective insulation and conduction from the gamma shield is eliminated. (auth)

18948 (TI-652-240-006) THERMAL TRANSIENT AND DEFLECTION ANALYSIS OF INTERNAL REFLECTOR: 5 Kwe REACTOR. Donovan, E. J.; Kudlja, C. T. (Atomics International Div., Canoga Park, Calif. (USA)). 2 Aug 1972. 12p. Dep. NTIS $4.00.

Thermal transient analyses were performed on the stainless steel clad internal reflector of the 5 kW(e) reactor. The assumed thermal transient was a linear NaK temperature ramp from 116^0F to 260^0F at a rate of 2.4^0F per second. This approximates the most severe portion of a reactor startup resulting from a 0.0025 cent/sec insertion with a 20 minute hold at 15 cents excess. Three internal reflector designs were evaluated. Although all designs would probably prove to be acceptable, the benign behavior of the NaK filled design makes it the preferred choice. (auth)

18949 (TI-652-240-007) RESULTS OF THE ADVANCED DIFFUSION–DILUTION MIXING TEXT MODEL AS APPLIED TO THE HOBBED-FIN 19 ELEMENT BUNDLE DATA. Anderson, R. V. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Sep 1972. 39p. Dep. NTIS $5.00.

Thorough investigation of results from all previous testing of Right-Left-Neutral fin geometries has led to the development of a mixing theory which postulates the existence of two distinct types of flow within the tricusp. This advanced mixing theory predicts axial saline concentration distributions which agree well with experimental data. A mixing correlation has resulted from this theory which is empirically matched to several sets of experimental data. This mixing correlation is dependent only upon the geometry of the R-L-N finned element being considered. 9 references. (auth)

18950 (TI-652-240-008) FUEL ELEMENT COMPUTERIZED STRESS ANALYSIS WITH CORE FORCE BALANCE. Castle, R. A. (Atomics International Div., Canoga Park, Calif. (USA)). 25 Aug 1972. 45p. Dep. NTIS $5.25.

A computer program was written to compute the fuel element stresses from the GEOM heat transfer code output. The forces on all 85 elements are balanced. Then the detailed bending six theta and local contact load stresses are computed for each element and the associated Margin of Safety calculated. (auth)

18951 (TI-652-240-010) HOT CHANNEL FACTORS FOR 5 KWe TE REACTOR. Felten, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 6 Sep 1972. 17p. Dep. NTIS $4.00.

Uncertainty factors for the fuel and coolant temperatures for the 5 kW(e) thermoelectric system reactor are presented. (JWR)

18952 (TI-652-240-011) FUEL ELEMENT GAP SELECTION FOR THE 5 kW(e) REACTOR. Rood, H. (Atomics International Div., Canoga Park, Calif. (USA)). 20 Sep 1972. 10p. Dep. NTIS $4.00.

The recommended fuel element gap for the 5 kW(e) reactor is 12 mils, cold, diametral. This provides space for fuel swelling, fuel segment bowing, dimensional tolerances, and hydrogen redistribution. In addition, enough margin is provided that full circumferential fuel/cladding contact at end of life is very unlikely. 8 references. (auth)

18953 (TI-652-240-016) LOADS INTRODUCED IN THE COLLAR BUTTON DEVICE BY FUEL SWELLING AND CREEP RELAXATION. Kudija, C. T. Jr. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Dec 1972. 13p. Dep. NTIS $4.00.

Load vs. time graphs are presented for several designs of the Collar Button Device (CBD). Effects such as prekink magnitude and retarded fuel swelling under load are investigated. (auth)

18954 (TI-652-260-001) 5 KWE REACTOR POWER DISTRIBUTIONS. Bost, D. S. (Atomics International Div., Canoga Park, Calif. (USA)). 26 Jun 1972. 16p. Dep. NTIS $4.00.

Power distributions representative of beginning and end of life are presented for the 5 kW(e) reactor. These distributions were obtained from DOT calculations in R, Z geometry. Reactivity worth of the sliding control segments was also obtained. (auth)

18955 (TI-652-260-002) 5 kW(e) REACTOR NUCLEAR PERFORMANCE ANALYSIS. Bost, D. S. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Sep 1972. 18p. Dep. NTIS $4.00.

A summary is given of the nuclear analysis of the conceptual design 5 kW(e) reactor T/E system. (4 references) (auth)

18956 (TI-652-260-004) PARTIAL TEMPERATURE COEFFICIENTS FOR THE 5 KWE REACTOR. Lekach, V. S. (Atomics International Div., Canoga Park, Calif. (USA)). 8 Feb 1973. 18p. Dep. NTIS $4.00.

Temperature coefficients for the 5 kW(e) reactor are calculated and compared to previous experiments and reactors. The recommended isothermal temperature coefficient is -0.18 cents/^{0}F. (auth)

18957 (TI-652-310-002.1) 5 kW(e) REFERENCE CONCEPTUAL DESIGN: SYSTEM HYDRAULICS. Lillie, A. F. (Atomics International Div., Canoga Park, Calif. (USA)). 25 Sep 1972. 21p. Dep. NTIS $4.25.

The hydraulic analyses, including power module hydraulics, for the 5 kW(e) Space Power System reference conceptual design (Dwg. N652630001) are presented. (7 references) (auth)

18958 (TI-652-310-003) MASS TRANSFER AND OXYGEN ANALYSIS IN THE SNAP 5 KWe GROUND TEST REACTOR. Eichelberger, R. L. (Atomics International Div., Canoga Park, Calif. (USA)). 9 Jan 1973. 11p. Dep. NTIS $4.00.

Mass transfer in the SNAP 5 kW(e) Ground Test Reactor System is discussed. It is shown that because the primary system consists of several different alloys, it is predisposed to be subject to mass transfer processes. For a given combination of materials, the rate at which mass transfer will occur depends upon the maximum temperature and the temperature difference in the loop, and upon the oxygen concentration of the NaK. In order that the system produce its rated power, the maximum temperature and the specified temperature difference must be obtained in operation, so that the only controllable factor affecting mass transfer is the oxygen impurity concentration in the NaK. 8 references. (auth)

18959 (TI-652-310-0022) REFERENCE PIPING DESIGN STRESS ANALYSIS. Westerman, S.; Mathias, S. (Atomics International Div., Canoga Park, Calif. (USA)). 22 Mar 1973. 68p. Dep. NTIS $6.50.

A history of the piping stress analysis is presented, tracing the work done from the conceptual stage to the final reference design layout. The piping stress analysis of the final reference design piping layout is also presented. (auth)

18960 (TI-652-320-003) 5 kW(e) SYSTEM RADIATOR THERMAL ANALYSIS. Montgomery, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Aug 1972. 28p. Dep. NTIS $4.50.

The 5 kW(e) system thermal radiator reference design is presented in two parts. The first portion describes the reference meteoroid armor equation used in preliminary design. The second portion describes the current reference design. (auth)

18961 (TI-652-320-005) 5 kW(e) SYSTEM LOCKALLOY RADIATOR THERMAL ANALYSIS. Montgomery, L. (Atomics International Div., Canoga Park, Calif. (USA)). 13 Sep 1972. 26p. Dep. NTIS $4.50.

The reference design of the 5 kW(e) reactor system thermal radiator using Lockalloy as the fin material is presented in two parts. The first portion describes the reference meteoroid armor equation used in preliminary design. The second portion describes the selection of the current reference design. (7 references) (auth)

18962 (TI-652-330-005) DUAL THROAT NaK PUMP PERFORMANCE EVALUATION (CENCEPTUAL DESIGN OF PROTOTYPE). Johnson, J. L. (Atomics International Div., Canoga Park, Calif. (USA)). 2 Oct 1972. 20p. Dep. NTIS $4.00.

An evaluation of the performance of the dual throat NaK pump for the 5 Kwe Reactor TE System is discussed. Performance at nominal operating conditions and at startup conditions is predicted. The basis for selection of this pump design is presented. (auth)

18963 (TI-652-510-002) ADDITIONAL 5 KWe THERMOELECTRIC SYSTEM TEMPERATURE TRANSIENTS. Halfen, F. J. (Atomics International Div., Canoga Park, Calif. (USA)). 25 May 1972. 66p. Dep. NTIS $6.50.

Several additional system transients have been calculated for the 5 kW(e) TE system and are reported in this document. They include a startup transient with a reactivity rate of 0.005 cents/sec, several startup accidents, a step reactivity insertion at full power and a loss of electrical load. These data are intended for input to system design analyses and for possible use in the protected accident section of the safety report. (auth)

18964 (TI-652-610-001) 5 Kwe REACTOR T/E UNMANNED SYSTEM TEST. Beoletto, J. A. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Sep 1972. 16p. Dep. NTIS $4.00.

Heat balances performed for components of the 5 kW(e) TE SNAP System during full power, steady state operation are reported and summarized. Radiation shunt losses from the primary NaK system to the secondary, heat rejection loop require the application of a low-emittance foil on the primary loop piping to minimize thermal shunting. (8 references) (auth)

18965 (TI-653-210-004) TEMPERATURE DISTRIBUTION IN THE SPF REACTOR SHIELD PLUG DURING OPERATION. Montgomery, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 17 Jan 1972. 11p. Dep. NTIS $4.00.

Steady state temperature distributions in the reactor support ring, shield plug, and actuator portions of the SPF reactor have been determined. The reactor was assumed to be operating at 300 kW(t) with a coolant inlet temperature of 1125^{0}F. Heat generation rates within the reactor support plate, shield material, and actuator motors were included. The results of this analysis indicate that a cold plate will not be necessary between the shield plug and the actuator and gear set support ring. (auth)

18966 (TI-653-240-005) 300 KWT CORE CONCEPTUAL MODEL THERMAL/HYDRAULIC CHARACTERISTICS. Moody, E. (Atomics International Div., Canoga Park, Calif. (USA)). 27 Jul 1971. 42p. Dep. NTIS $5.25.

The 300 kW(t), 199 element NASA-Lewis/AEC core conceptual model, has been analyzed to determine it's thermal-hydraulic characteristics using the GEOM-3 code. Stack-ups of tolerances and fuel rod asymmetry patterns were used to ascertain cross element DELTA T's. Both zoned and uniform spacing were analyzed with a somewhat lower fuel temperature and cross element DELTA T found for zoned spacing. With the models considered, the core design appears adequate to limit thermal gradients to approximately 32^{0}F. Bypass flow should be controlled to prevent excessive edge element DELTA T's. 11 references. (auth)

18967 (TI-653-240-010) CLUSTER/ASYMMETRY EFFECTS ON SPF REACTOR, .750 PITCH. Moody, E. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Nov 1971. 32p. Dep. NTIS $4.75.

Eleven cluster/asymmetry configurations have been examined in an attempt to bound realistic thermal gradients for stress analysis. A maximum equivalent DELTAT of 32^{0}F was found in these cases. The study showed that asymmetry is the controlling factor in both magnitude and direction of cross element DELTAT. (auth)

18968 (TI-653-240-019) FUEL ELEMENT STRESS ANALYSIS STATUS FOR SPF REACTOR CONCEPTUAL DESIGN. Castle, R. A. (Atomics International Div., Canoga Park, Calif. (USA)). 3 Dec 1971. 63p. Dep. NTIS $6.25.

A summary of the fuel element stress analysis conducted to date for the SPF reactor conceptual design is presented. Two basic fuel element configurations were analyzed; one is a 0.027 inch wall thickness Hastelloy-X design; the other a 0.032 inch wall thickness

Incoloy 800 design. Both elements are interchangeable in the same core assembly. The analysis to date shows that the structural integrity of either element is maintained through the expected environment. (auth)

18969 (TI-653-240-027) DEVELOPMENT OF A FORMULA FOR CALCULATING ZIRCONIUM HYDRIDE FUEL SWELLING. Roberts, W. J. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Jun 1972. 49p. Dep. NTIS $5.50.

A model is developed to describe irradiation induced growth in zirconium hydride or for heavy ion accelerator irradiation of structural materials. The model is based on the phenomenon of volume saturation occurring as a result of annealing of irradiation produced dislocations. The model was proposed by Hudson, Mazey and Nelson for swelling in Ni irradiated with C^{++} ions. The model predicts a strong temperature and weak flux sensitivity. A sensitivity is shown to lower temperature, higher power operation following an initial steady operation. (auth)

18970 (TI-653-260-001) COMPARISON OF CALCULATED AND EXPERIMENTAL REACTIVITIES OF SNAP REACTORS. Bost, D. S. (Atomics International Div., Canoga Park, Calif. (USA)). 4 Aug 1971. 48p. Dep. NTIS $5.50.

The reactivities of S8ER, the S8ER core in SCA-4B, S8DR, and SCA-4A were calculated using current methods and cross section data for comparison with experiment. A variety of core loadings and reflector shim configurations were used, making a total of twelve calculations. These may be grouped into six near critical and six significantly supercritical configurations. The mean error and standard deviation was -0.11 ± 1.53$ for all calculations, +0.51 ± 1.05$ for the near criticals, and -0.73 ± 1.76$ for the supercritical. (auth)

18971 (TI-653-260-003) EFFECT OF PREPOISONS ON THE NUCLEAR BEHAVIOR OF THE 450 KWt AND 300 KWt ZrH REACTORS. Bost, D. S. (Atomics International Div., Canoga Park, Calif. (USA)). 28 Sep 1971. 20p. Dep. NTIS $4.00.

Results of non-dimensional burnup calculations on 450 kW(t) and 300 kW(t) reactors are presented. Varying amounts and combinations of Sm, Gd-155, and Eu-151 prepoisons were investigated. (auth)

18972 (TI-696-13-003) NORMALIZED POISON-BACK CONTROL DRUM WORTH FOR THE REFERENCE DESIGN, ZrH REACTOR. Rood, H. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Feb 1968. 15p. Dep. NTIS $4.00.

The worth of ten, 4.5'' diameter poison backed drums around the Reference Advanced ZrH Reactor is estimated to be $10.00 ± $1.70. These drums consist of a 1.5'' thick poison segment of 60 volume % EU_2O_3 in Nickel, and a 3.0'' thick reflecting segment of BeO. (auth)

18973 (TI-696-13-006) REACTOR DESIGN EVOLUTION, REFERENCE DESIGN ZrH REACTOR, TE. Richter, H. E. Jr. (Atomics International Div., Canoga Park, Calif. (USA)). 26 Feb 1968. 48p. Dep. NTIS $5.50.

The selected reference design ZrH Reactor is described. Conceptual design arrangements studied are described and their effect on selection of the reference design is documented. (auth)

18974 (TI-696-13-013) REACTIVITY EFFECTS OF GADOLINIUM 155 ON A SNAP REACTOR. Heneveld, W. H.; Swanson, V. A. (Atomics International Div., Canoga Park, Calif. (USA)). [nd]. 70p. Dep. NTIS $6.50.

Results of experimental measurements of reactivity effects of various concentrations of gadolinium 155 on a SNAP Reactor are presented. Included are reactivity worth measurements with a water immersed core, temperature defect measurements, and transient test results in the SNAPTRAN machine. (auth)

18975 (TI-696-13-014) NUCLEAR MODEL FOR A 295 ELEMENT REFERENCE ZrH REACTOR AND SHIELD, DRUM POISON ROTATED OUT. Ottewitte, E. H. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Oct 1968. 26p. Dep. NTIS $4.50.

A two-dimensional nuclear model was prepared for current studies of a 295 element Reference ZrH Reactor and Shield. (auth)

18976 (TI-696-13-032) REFERENCE 295 ELEMENT ZrH REACTOR STARTUP TRANSIENTS WITH FLOW RATE AND UA VARIATIONS. Halfen, F. J. (Atomics International Div., Canoga Park, Calif. (USA)). 24 Apr 1969. 43p. Dep. NTIS $5.25.

An analysis of startup transients for the 295 element Reference ZrH Reactor with a thermoelectric power conversion system has been made in an effort to determine the effects of S3DR-type UA variation on these transients. In general the S8DR-type UA variation causes larger and more rapid temperature transients. These can be mitigated by increasing initial NaK flow or decreasing startup reactivity rate moderately. (auth)

18977 (TI-696-13-050) REACTOR PERFORMANCE CHANGES NECESSARY TO COUNTERACT THERMO-ELECTRIC CONVERTER DEGRADATION. German, G. E. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Jun 1970. 26p. Dep. NTIS $4.50.

The effects that degrading thermoelectric (TE) converters have upon reactor performance are calculated. It is shown that beginning-of-life (BOL) reactor coolant outlet temperature and TE converter degradation rate are key design factors that must be properly set to avoid reactor operation at outputs and temperatures where accelerated reactor degradations occur. It is also shown that the rise time to reach a specific reactor coolant outlet temperature is independent of the TE converter conversion efficiency. It is concluded that five year power systems using state-of-the-art TE converters are feasible if the proper BOL reactor coolant outlet temperature is selected. A data display suitable for adjusting BOL reactor temperature and TE converter degradation rate objective for 5 year power systems is provided. (auth)

18978 (TI-696-13-125) REF. 259 ZrH REACTOR STARTUP TRANSIENTS THROUGH THE FIRST POWER BURST TO 300°F NaK OUTLET TEMPERATURE. Halfen, F. J. (Atomics International Div., Canoga Park, Calif. (USA)). 9 Jan 1969. 71p. Dep. NTIS $6.75.

An analysis of initial startup transients through the first power burst to 300°F NaK outlet temperature has been made for the reference 295 element ZrH reactor with a thermoelectric power conversion system. Allowable reactivity insertion rate during this phase of startup is reported as a function of initial NaK flow rate and temperature coefficients of reactivity. The reactor model used is also reported in some detail along with selected temperature transients at several locations in the system. (auth)

18979 (TI-696-20-001) THERMAL ANALYSIS: ADVANCED ZIRCONIUM HYDRIDE REACTOR. Beiriger, F. P. Jr. (Atomics International Div., Canoga Park, Calif. (USA)). 8 May 1968. 26p. Dep. NTIS $4.50.

Preliminary thermal analyses were performed on the Advanced Zirconium Hydride reactor vessel, drum drive bearings and shield at reactor operating power levels of 600 and 1200 kW(t). Several different geometries were analyzed in each of these areas to develop a configuration that will satisfy the thermal, stress and mechanical requirements. Steady state temperatures were calculated for the drum drive bearings and composite shield designs. Transient temperatures were calculated for the vessel upper head and dry well and the lower vessel head and sidewall. The reactor startup transient was simulated by ramping the NaK inlet and outlet temperatures. Temperatures were calculated from thermal nodal models of the various reactor components using the TAP-4F digital computer code. The thermal and physical constants used for the analysis and selected temperature data are presented. (auth)

18980 (TI-696-21-003) ZrH REACTOR VESSEL STRESSES. Dauterman, W. H. (Atomics International Div., Canoga Park, Calif. (USA)). 22 Apr 1969. 17p. Dep. NTIS $4.00.

Stress and design margins for the ZrH reactor vessel are summarized. (JWR)

18981 (TI-696-23-004) Na-24 ACTIVITY IN THE REFERENCE ZrH REACTOR SHIELD GALLERY. Keshishian, V. (Atomics International Div., Canoga Park, Calif. (USA)). 27 Aug 1968. 3p. Dep. NTIS $4.00.

Preliminary saturated Na-24 activity in the reference ZrH reactor primary coolant system was calculated to be 594.4 curies. Of this amount, 260 curies are in the gallery region. The unshielded dose rate from Na-24 in the gallery was calculated to be 158 mrem/hr at a separation distance of 150 feet. The above is for 600 kW(t). (auth)

18982 (TI-696-23-025) REFERENCE ZrH REACTOR SHIELD DESIGN CALCULATIONS. Goetz, C. A. (Atomics International Div., Canoga Park, Calif. (USA)). 18 Apr 1969. 15p. Dep. NTIS $4.00.

Details of the calculations in support of the reference shield configuration for the 295 ZrH Reactor are reported. 6 references. (auth)

18983 (TI-696-23-040) NUCLEAR HEATING IN REFERENCE ZrH REACTOR SHIELD. Thomson, R. J.; Schwab, G. V. (Atomics International Div., Canoga Park, Calif. (USA)). 17 Dec 1969. 13p. Dep. NTIS $4.00.

Internal heat generation in the conceptual design shield was found to be 7.82 kW. This is about half the preliminary estimate made during the shield materials trade study. Spatial distribution of this heating is presented so that heat transfer calculations may be performed and shield operating temperatures determined. 4 references. (auth)

18984 (TI-696-23-043) TANTALUM GAMMA SHIELD. Schwab, G. V.; Thomson, R. J. (Atomics International Div., Canoga Park, Calif. (USA)). 13 Jan 1970. 3p. Dep. NTIS $4.00.

The reference gamma shield material for the Reference ZrH Reactor is tungsten. Since this material is brittle, tantalum-10W has been suggested as an alternate. This study found that in the reference system, the two materials are essentially identical from a nuclear and weight standpoint. (auth)

18985 (TI-696-26-003) THERMAL CYCLE, SHOCK, ACCELERATION AND VIBRATION TESTING OF A BeO REFLECTOR SPECIMEN, PART NO. EX-N69626085. Welch, F. H. (Atomics International Div., Canoga Park, Calif. (USA)). 24 Apr 1969. 53p. Dep. NTIS $5.75.

Test results and recommendations are presented. A BeO block representing a section of the 4 Pi reflector was thermal cycled to 1300°F, and then subjected to a series of shock, vibration and acceleration tests which simulated the prelaunch thermal cycles and launch shock and vibration condition. Examination of the block revealed no damage to have occurred after vibration tests up to 85 g's. The tests demonstrated that the BeO block and its mountings are adequate for the design loads. (auth)

18986 (TI-696-31-002) HELICAL INDUCTION PUMP DESIGN. Donelan, L. E. (Atomics International Div., Canoga Park, Calif. (USA)). 17 Jul 1970. 19p. Dep. NTIS $4.00.

Preliminary design work resulting in the calculation of a pump based on the helical induction principle is reported. Report contains expected performance curves, size, etc. (auth)

18987 (TI-696-41-010) NaK PUMP PERFORMANCE. Leonard, W. D. (Atomics International Div., Canoga Park, Calif. (USA)). 11 Feb 1969. 25p. Dep. NTIS $4.25.

The performance of the DC conduction pumps for the ZrH Reactor thermoelectric system has been calculated for operation both at design conditions and off-design conditions. The results are presented in terms of pressure developed and voltage required for the pump. (7 references) (auth)

18988 (TI-700-13-010) PREDICTION OF ABLATION DEPTHS OF LITHIUM HYDRIDE SHIELD DURING REENTRY, INCLUDING A STUDY OF THE EFFECTS OF NODE SIZE ON CALCULATED ABLATION RATES. Elliott, R. D. (Atomics International Div., Canoga Park, Calif. (USA)). 11 Nov 1969. 10p. Dep. NTIS $4.00.

Calculations were made using a one-dimensional thermal model of a section through the lithium hydride shield surrounding the ZrH reactor. It was found that, for a representative reentry trajectory and for an assumed aerodynamic heating factor of 0.535, about 4.8 in. of hydride would ablate before the end of the heating period. The validity of the heating factor used has not yet been established, so these results should be considered to be preliminary. The insensitivity of the calculated ablation rates to node thickness of interest in the thermal model was established. (auth)

18989 (TI-700-13-013) IMPACT TEST DATA OF ZrH REACTOR SYSTEM. Lee, S. L. (Atomics International Div., Canoga Park, Calif. (USA)). 4 Mar 1970. 43p. Dep. NTIS $5.25.

As part of the post impact disassembly studies of the ZrH reactor a series of impact tests have been conducted on the principal reactor materials. This report presents the basic equations used in determining the impact energy balance between the test specimens and the target at impact. With the aid of these equations the energy absorption capacity of the materials tested is determined. The effects of irradiation on 304 SS are presented indicating that the energy absorbing capacity of the reactor vessel will not be affected by irradiation. Modeling laws are shown that indicate that it is possible to predict the post impact configuration of the reactor by scale model testing. (auth)

18990 (TI-700-13-015) REFERENCE ZrH REACTOR POWER SYSTEM FOR NASA SPACE STATION POST-OPERATIONAL REENTRY ANALYSIS. Elliott, R. D. (Atomics International Div., Canoga Park, Calif. (USA)). 5 Mar 1970. 50p. Dep. NTIS $5.50.

The flight dynamic and heating of a spent ZrH reactor power system returning from orbit at the end of its useful life are analyzed. The results of this analysis indicate that the reactor with a large portion of the lithium shield still surrounding it will impact the earth at a velocity of from 660 to 820 ft/sec, depending upon whether it tumbles or becomes stabilized during the latter part of its trajectory. (auth)

18991 (TI-700-13-016) PRELIMINARY DATA FROM LITHIUM HYDRIDE ABLATION TESTS CONDUCTED BY NASA, AMES RESEARCH CENTER. Elliott, R. D. (Atomics International Div., Canoga Park, Calif. (USA)). 5 May 1970. 9p. Dep. NTIS $4.00.

A series of ablation tests of lithium hydride has been made by NASA-Ames in one of their high-enthalpy arc-heated wind tunnels. Two-inch diameter cylindrical samples of the hydride, supplied by A. I., were subjected to heating on their ends for time periods up to 10 seconds. After each test, the amount of material removed from each sample was measured. The rates of loss of material were correlated with the heat input rates in terms of a heat of ablation, which ranged from 2100 to 3500 Btu/lb. The higher values were obtained when the hydride contained a matrix such as steel honeycomb of steel wool. (auth)

18992 (TI-700-14-004) THE INFLUENCE OF POISON MATERIALS ON THE PROMPT TEMPERATURE COEFFICIENT OF A SNAP REACTOR: THEORY VS EXPERIMENT. Dray, B. J.; Rhoades, W.; Rood, H. (Atomics International Div., Canoga Park, Calif. (USA)). 29 Jun 1970. 19p. Dep. NTIS $4.00.

Recent transient experiments were performed to determine the effect of Gd-155, Sm-149 and Eu-151 prepoison materials on the prompt temperature coefficient of the SNAPTRAN-1 machine. Calculations were performed using AI's 28-group nuclear cross section library in a variant of the APC neutron transport code. These calculated coefficients are in rough agreement with the experiments between 200 and 500°F. Above 500°F the calculations indicate coefficients which are too positive for all the poisoned configurations. 13 references. (auth)

18993 (TI-700-28-011) FABRICATION OF NICKEL–GADOLINIUM OXIDE FOIL SLEEVES FOR SNAPTRAN. Mahoney, M. W. (Atomics International Div., Canoga Park, Calif. (USA)). 9 Jan 1968. 4p. Dep. NTIS $4.00.

A requirement exists for sleeves made of nickel foil containing selected concentrations of Gd_2O_3 as a dispersion. The foils will be installed around individual SNAP-10A fuel elements for special physics tests. A brief program was successfully conducted to develop the process for fabrication of the required sleeves. (auth)

18994 (TI-759-200-001) CONCEPTUAL CORE MODEL FOR THE REACTOR CORE TEST. Swensen, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 16 Nov 1970. 8p. Dep. NTIS $4.00.

Several design options for the ZrH Flight System Reactor were investigated which involved tradeoffs of core excess reactivity, reactor control, coolant mixing and cladding thickness. A design point was selected which is to be the basis for more detailed evaluation in the preliminary design phase. The selected design utilizes 295 elements with 0.670 inch element-to-element pitch, 32 mil thick Incoloy cladding, 18.00 inches long fuel meat, hydrogen content of 6.3×10^{22} atoms/cc fuel, 10.5 w/o uranium, and a spiraled fin configuration with alternate elements having fins with spiral to the right, spiral to the left, and no fin at all (R-L-N fin configuration). Fin height is 30 mils for the center region of the core and 15 mils for the outer region. (auth)

18995 (TI-759-200-002) USE OF HASTELLOY X-280 IN REACTOR CORE TEST ALTERNATE CONCEPTUAL DESIGN. Swenson, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 24 Nov 1970. 5p. Dep. NTIS $4.00.

A cursory investigation was performed to access the feasibility of using 20 mil thick Hastelloy X-280 cladding in place of the 32 mil thick Incoloy 800 in the conceptual core model for the Reactor Core Test. Fuel and cladding dimensions are presented as are the extrapolated changes in core excess and control worth. 4 references. (auth)

18996 (TI-759-200-008) HASTELLOY X FUEL ELEMENT CREEP RELAXATION AND RESIDUAL EFFECTS. Castle, R. A. (Atomics International Div., Canoga Park, Calif. (USA)). 28 Jan 1971. 16p. Dep. NTIS $4.00.

A worst case, seven element, asymmetric fuel, thermal environment was assumed and a creep relaxation analysis generated. The fuel element clad is .020 inch Hastelloy X. The contact load decreased from 11.6 pounds to 5.87 pounds in 100,000 hours. The residual stresses were then computed for various shutdown times. (auth)

18997 (TI-759-230-003) CORE TEST REACTOR SHIELD COOLING SYSTEM ANALYSIS. Larson, E. M.; Elliott, R. D. (Atomics International Div., Canoga Park, Calif. (USA)). 5 May 1971. 34p. Dep. NTIS $4.75.

System requirements for cooling the shield within the vacuum vessel for the core test reactor are analyzed. The total heat to be removed by the coolant system is less than 22,700 Btu/hr, with an additional 4600 Btu/hr to be removed by the 2-inch thick steel plate below the shield. The maximum temperature of the concrete in the shield can be kept below 200°F if the shield plug walls are kept below 160°F. The walls of the two "donut" shaped shield segments, which are cooled by the water from the shield and vessel cooling system, should operate below 95°F. The walls of the center plug, which are cooled with nitrogen, should operate below 100°F. (auth)

18998 (TI-759-240-007) ZrH REACTOR LATTICE SPACING (HEAT TRANSFER CONSIDERATIONS). Felten, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 25 Sep 1970. 18p. Dep. NTIS $4.00.

Temperature calculations for a 295 element ZrH reactor at fuel element spacings from 0.010" to 0.065" showed a very small dependence of reactor temperature on element spacing. It was found that one variation in coolant channel area (2 zones) was sufficient to satisfactorily shape the radial flow profile for the core. (auth)

18999 (TI-759-240-016) EFFECT OF CLADDING WALL THICKNESS AND GAS GAP WIDTH ON CIRCUMFERENTIAL TEMPERATURE GRADIENTS AND FILM COEFFICIENTS FOR ROD BUNDLES HAVING A P/D equals 1.00. Marchese, A. R. (Atomics International Div., Canoga Park, Calif. (USA)). 29 Oct 1970. 6p. Dep. NTIS $4.00.

For the case of NaK flowing in-line through a rod bundle with P/D equals 1.00, calculations are presented showing the effect of cladding wall thickness and gas gap width on the azimuthal temperature gradient and convective film coefficient. Calculations are given for a typical set of test reactor conditions. (auth)

19000 (TI-759-240-030) DIMENSIONAL STABILITY OF HEAVY WALLED INCOLOY 800 CLADDING TUBES, DATA. Roberts, J. T. (Atomics International Div., Canoga Park, Calif. (USA)). 25 Feb 1971. 17p. Dep. NTIS $4.00.

The effects of SCB coating, thermal shock and thermal soak on the dimensional stability of four heavy walled Incoloy 800 cladding tubes, ranging in thickness from 20 to 44 mils, were investigated. This report serves as a repository for the detailed data and profilometer traces used in the preparation of the data summary. (auth)

19001 (TI-759-240-035) FUEL ROD FINITE ELEMENT STRESS ANALYSIS: SEGMENTED FLIGHT REACTOR FUEL VERSUS S8DR FUEL. Anderson, R. V. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Mar 1971. 42p. Dep. NTIS $5.25.

A finite element stress analysis has been performed to define the stresses which exist near the delta/epsilon boundary in the fuel rod. Seven analyses were performed including an S8DR fuel rod at BOL and during one magawatt operation, and a core test segmented fuel rod with 3.0, 4.5, and 6.0 inch segments and worst-case boundary locations. Results indicate that maximum tensile stresses induced in the core test fuel segments are at least 20 percent lower than those induced in the S8DR rod during BOL (600 KWT) operation and at least 35 percent lower than the S8DR rod during magawatt operation. (5 references) (auth)

19002 (TI-759-240-038) NaK FILM COEFFICIENTS AND 6 THETA TEMPERATURE RIPPLES FOR THE ZrH REFERENCE REACTOR. Felton, L. D. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Apr. 1971. 21p. Dep. NTIS $4.25.

The TAP computer program was used to model a 180^0 segment of a fuel cell of the reference reactor. Thermal analyses of nominal conditions were made to determine 6 theta temperature ripples and NaK film heat-transfer coefficients. Effects of cladding thickness and coolant mixing are treated. (12 references) (auth)

19003 (TI-969-13-045) POWER HISTORIES FOR 295 ELEMENT ZrH REACTOR DURING STATIC CONTROL DRIFTDOWN. Clemmer, T. A. (Atomics International Div., Canoga Park, Calif. (USA)). 29 Dec 1969. 27p. Dep. NTIS $4.50.

Power histories have been calculated for the 295 element reference ZrH reactor. The power histories include cases for varying loadings of burnable poisons and Tritium-Helium for EOL shutdown. Power histories generated may be considered conservative from the standpoint of safety analyses. (8 references) (auth)

19004 (TID/SNA-1440) OPERATIONAL DESCRIPTION OF THE DUCT ANALYSIS PROGRAM JOB 12007. Stiger, R. R. (Aerojet Liquid Rocket Co., Sacramento, Calif. (USA)). Feb 1964. 20p. Dep. NTIS $4.00.

The Duct Analysis Program, using an iterative logic scheme, calculates flow rate, pressures and temperatures, and determines if the flow is subsonic or supersonic for any duct fed by a converging, diverging nozzle. The analysis assumes an isentropic nozzle, a constant area duct, and an adiabatic system. The program assumes supersonic flow, and calculates the pressure at the duct exit. The calculated back pressure is compared with the input pressure; if the input back pressure is smaller, the problem is solved. If not, the program assumes a shock at the duct exit and compares pressures again. If the exit pressure is higher than the back pressure, the program is terminated; if not, the program assumes a shock at the exit of the nozzle which coincides with the duct entrance. The revised duct exit pressure is again calculated, and the program investigates three possibilities: (1) the back pressure equals the exit pressure and the system is balanced; (2) the back pressure is lower than the duct exit pressure, and the shock is standing in the exit duct. The program iterates and finds the shock position that results in a system balance; and (3) the back pressure is larger than the duct exit pressure, therefore, the shock is in the nozzle or the system is subsonic. The program iterates on the shock location to balance the system. If the shock occurs at a mach number of one or less, the system is treated as being subsonic and is solved. (auth)

19005 (TID/SNA-1441) NRX-A PROPELLANT INLET ASSEMBLY S/N 002 VIBRATION SURVEY EVALUATION REPORT. Willson, G. M.; Cornell, A. D. (Aerojet-General Corp., Sacramento, Calif. (USA)). 12 Jun 1964. 60p. Dep. NTIS $6.00.

Vibration surveys of the NRX-A Propellant Inlet Assembly, S/N 002, were successful in (1) establishing dynamic response characteristics under controlled vibration conditions of 4-150 Hz, and (2) determining the fundamental resonant frequencies and associated mode shapes of the assembly. A number of well-defined resonant frequencies were disclosed within the frequency range of 4-150 Hz, with excitation levels of .1 g, .2 g, and .5 g. Excitation applied in the plane of the feed line excited seven resonant frequencies at nominal frequencies of 10, 20, 52, 69, 93, 112, and 145 Hz. The maximum response was observed at the resonant modes at 52 and 69 Hz. Vibration in an axis perpendicular to the plane of the line assembly disclosed resonant frequencies of 5, 21, 35, 51, and 94 Hz. The greatest response occurred at 94 Hz. (auth)

19006 (TID/SNA-1442) TEST PLAN FOR STRUCTURAL PROOF AND EVALUATION TEST, SEAL TEST VESSEL. Locke, J. N. (Aerojet-General Corp., Sacramento, Calif. (USA)). 11 Dec 1963. 13p. Dep. NTIS $4.00.

The general test specifications for a structural proof test of the seal test vessel are described. The test will consist of hydrostatically pressurizing the vessel assembly, consisting of a mockup cylinder and closure at ambient temperature. The objectives are to demonstrate that the seal test vessel is capable of withstanding ambient temperature proof pressure and to measure flange rotation and displacement. (auth)

19007 (TID/SNA-1487) PHOEBUS TEST FACILITY PROPOSED TURBINE DRIVE SYSTEM CONVERTING LIQUID TO HOT GAS. (Aetron, Covina, Calif. (USA)). May 1965. 27p. Dep. NTIS $4.50.

The cost of gas storage capacity for hot GH_2 testing of components becomes prohibitive when runs are of long duration and it is more economical to provide the additional heating capacity to heat LH_2. This proposal is for the necessary facilities to supply hot HG_2 at a rate of 25 pounds per second, and at a temperature of 1,400°R for a duration of 20 minutes from liquid hydrogen. The layout shown is somewhat generalized, as are the lengths of connecting lines. Development of the design will produce changes consistent with the site conditions to be met. (auth)

19008 (TID/SNA-1488) SPECIFICATIONS FOR ETS-1 EXHAUST DUCT. (Aetron, Covina, Calif. (USA)). Jan 1966. 95p. Dep. NTIS $7.75.

19009 (TID/SNA-1493) NERVA TECHNICAL DISCUSSIONS BY SUBTASK, CY 1964. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1964. 117p. Dep. NTIS $9.00.

Detailed research program plans for NERVA development work in CY 1964 are presented. (LTN)

19010 (TID/SNA-1539) STEAM GENERATOR EQUIPMENT FOR E/STS 2-3. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1967. 72p. Dep. NTIS $6.75.

Recommendations are made for a chemical steam generation system for the NERVA altitude test facility E/STS 2-3 at Jackass Flats, Nevada. A unique system, designed to use available Titan I hardware, has been conceived which will provide the required quantities of steam in a reliable, safe, and economical manner. The steam generator proposed consists of a vertical vessel with integrally mounted steam generator modules. Reactant and water pumps and associated instrumentation and control components, including a control console, will also be supplied. The generator modules will incorporate fully developed and proven Titan I injectors to assure maximum reliability, safety, and economy. (auth)

19011 (TID/SNA-1864) EFFLUENT SCRUBBER PRESENTATION TO SNPO-WASHINGTON. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 33p. Dep. NTIS $4.75.

The presentation concluded that the accidental release of half the fission products contained in a NERVA reactor after a 50 minute, full power test would lead to serious contamination in

and beyond the site area (depending on meteorological conditions). Evacuation of on-site personnel would be necessary. Child and adult thyroid dosages from milk and from inhalation were considered. For normal test operations, using beaded fuel and no scrubber, carried out under good meteorological conditions, off-site dose criteria are not exceeded (but the milk-ingestion dose from a single average test is marginal in some areas). With a 90 percent efficient scrubber and tests carried out under good meteorological conditions, forty-eight such 50 minute tests could be run per year without exceeding the milk dose limit. Composite type fuels are dirtier by an order of magnitude and an efficient scrubber becomes even more essential, even to assuring control point safety and early access to the site following a test. (LTN)

19012 (TID/SNW-40) PW-2 DUPLEX COATING DEVELOPMENT, WNCO. Revision 1. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 9p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

A plan is developed to study process parameters and fixture designs for coating fuel elements with a GEM (NbC) base coat/HED (ZrC) hot end overcoat and specified thickness profile to give maximum performance capability at PW-2 conditions. Inspection and evaluation techniques are specified. (LTN)

19013 (TID/SNW-42) NR FUEL DEVELOPMENT TEST SPECIFICATION IIF-b, FUEL ELEMENT IMPREGNATION. Johnson, M. T.; Corrington, L. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1967. 12p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

An experiment is planned to investigate possible beneficial results from niobium metal resinate impregnation of high void fuel elements. Coatings to be applied and inspection and corrosion testing of the products are specified. (LTN)

19014 (TID/SNW-87) NR FUEL ELEMENT DEVELOPMENT TEST SPECIFICATION. Phase IV B, Revision 1. Jackson, J.; Holmgren, J. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 23p. Dep. NTIS $4.25.

Declassified 11 Sep 1973.

Development specifications are defined to provide high void fraction fueled elements, representing best currently available matrix and coating procedures, for NR electrical screening test and for evaluation as NR reactor candidates. The corrosion test performance of high void fraction elements will be evaluated under conditions approximately 110% of the average NR power density and corresponding hydrogen flow, such that an exit gas temperature of 4550°R is attained. The effect of NRX-A6R standard processing on high void fraction element corrosion performance will be evaluated. The effect of impregnated versus standard matrix high void fraction fuel elements in corrosion test performance will be compared. The effect of selected low-temperature NbC coatings with and without X-overcoating on high void fraction fuel element corrosion performance will be determined. (auth)

19015 (TID/SNW-92) NRX-A2 STATUS PRESENTATION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Mar 1964. 44p. Dep. NTIS $5.25.

19016 (TID/SNW-122) HIGH FUEL LOADING. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1968. 10p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

Experiments in fuel element fabrication are planned, using Westinghouse technology, to minimize the effects of increased fuel loading on strength and leak rate, which are expected to be serious in advanced reactors with present methods. The experimental and control elements will be characterized by specified mechanical tests, metallography, physical measurements and corrosion tests. (LTN)

19017 (TID/SNW-123) FIFTH MONTHLY REPORT OF WNCO FUEL ENGINEERING. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Feb 1971. 58p. Dep. NTIS $6.00.

Declassified 10 Sep 1973.

19018 (TR-652-360-001) NaK HEAT TRANSFER STUDY FOR A 19-ROD BUNDLE (P/D equals 1.05) EMPLOYING HELICAL-FIN SPACERS. Marchese, A. R. (Atomics International Div., Canoga Park, Calif. (USA)). 26 Jul 1972. 108p. Dep. NTIS $8.25.

An experimental heat transfer study is reported for the case of longitudinal flow of a liquid metal (NaK-78) through a closely spaced rod bundle. Heat transfer results for the cladding circumferential temperature distributions and the rod-average film coefficients were obtained over a range of heating and flow conditions of interest to a compact ZrH reactor core. Because of the increased intra-channel turbulence created by the helical-fins, negligible rod azimuthal temperature variations and significantly improved rod-average film coefficients were observed. In the flow range investigated, the heat transfer results were found to be independent of the Peclet number. In addition, the effects of fin-induced inter-channel mixing, or crossflow, was to significantly reduce coolant channel-to-channel temperature differences. (7 references) (auth)

19019 (TR-653-210-002) OPEN CHANNEL PLENUM MODEL HYDRAULIC DEVELOPMENT TEST: FLARED INLET LINES. Nakae, T. S.; Poucher, F. W.; Steele, O. P. III. (Atomics International Div., Canoga Park, Calif. (USA)). 14 Mar 1972. 43p. Dep. NTIS $5.25.

The test results are presented of the hydraulic studies on the SPF open channel Inlet Plenum Model with flared inlet lines. An evaluation was made of the effectiveness of 4 and 5-vane diffusers in 2 x 3 straight flared inlets, 5-vane diffusers in 2 x 3 curved flared inlets and 5-vane diffusers in 2 x 4 straight flared inlets. The 5-vane diffusers in 2 x 3 straight flared inlets provided the flattest pressure profiles at the grid plate and were recommended for incorporation into the plenum design. (auth)

19020 (TR-653-240-004) MACHINING CAPABILITY OF HOBBING SNAP CLADDING FINS. Schrag, F. C. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Jul 1971. 19p. Dep. NTIS $4.00.

Three helical fins were machined on fifty-one Incoloy 800 cladding tubes by hobbing. This machining technique was to meet SNAP 8 dimensional requirements. The inspection data are presented along with a summary dimensional analysis. (auth)

19021 (TR-653-240-005) RESULTS OF ADDITIONAL STUDIES OF INSTRUMENTATION AND FLOW MIXING IN THE ZrH 19-ELEMENT TEST BUNDLE. Ostermier, B. J. (Atomics International Div., Canoga Park, Calif. (USA)). 24 Nov 1971. Dep. NTIS $4.75.

Results are reported for a series of tests recording injected salt concentrations in the instrumented ZrH nineteen element test bundle. These results are presented as plots versus axial location of the fraction of calculated injected salt tracer detected by probes along the bundle flow channels. Data were recorded for different probe-to-flow-channel orientations and are interpreted both to evaluate the ability of probes to detect average channel salt concentration and to identify flow characteristics in the test bundle. A portion of the results presented are for improved data recorded after instrumentation was modified to eliminate signal interactions in the electrode leads. 5 references. (auth)

19022 (TR-653-240-006) EXPERIMENTAL STRESSES FOR A CONTACT LOAD ON SIMULATED SPF REACTOR FUEL ELEMENTS. Castle, R. A.; Cardenas, R. J. (Atomics International Div., Canoga Park, Calif. (USA)). 27 Mar 1972. 341p. Dep. NTIS $20.25.

As part of the SNAP reactor program a structural test was conducted on simulated fuel elements to determine experimentally the stresses on the inner surface of the cylinder due to local contact loads. These local loads were applied by simulated fuel elements with helical fins 0.072 inch to 0.160 inch wide on a 5½ inch pitch, acting on ¾ inch diameter thin walled cylinders, 21 inches long which were internally strain gaged. The results were correlated with analytical efforts utilizing a Bijlaard analysis. Stresses were also determined for the case where plain tube was loaded against a bowed plain tube. 6 references. (auth)

19023 (TR-653-360-001) EXPERIMENTAL STUDY OF HEAT TRANSFER TO NaK FLOWING IN-LINE THROUGH TIGHTLY PACKED ROD BUNDLES. Marchese, A. R. (Atomics International Div., Canoga Park, Calif. (USA)). 10 Oct 1971. 158p. Dep. NTIS $11.00.

An experimental heat transfer study is reported for the case of longitudinal flow of NaK through tightly packed rod bundles having pitch-to-diameter (P/D) ratios of 1.00 and 1.05. Although the flow was turbulent, the Peclet number range was low enough such that eddy conduction was negligible. Each rod bundle consisted of 19 cylindrical rods arranged on hexagonal arrays. All rods in the bundle were electrically heated to provide equal and axially uniform heat flux. To determine the rod circumferential temperature distribution, small diameter thermocouples were welded to the inside cladding tube on all heaters. In addition, sufficient instrumentation was provided to measure the coolant temperature distribution at the inlet and outlet to the rod bundle, the power supplied to each rod, and the coolant flow rate. Fully established heat transfer results for the cladding azimuthal temperature distributions and rod-average film coefficients were obtained over a range of power and flow conditions of interest to the ZrH reactor. (auth)

19024 (TT-652-210-004) STRUCTURAL ANALYSIS OF FUEL ELEMENT CLADDING FOR LONG TERM FUEL SLUG GROWTH. Leary, R. E.; Meertens, J. (Atomics International Div., Canoga Park, Calif. (USA)). 5 Feb 1973. 24p. Dep. NTIS $4.25.

An elastic and creep structural analysis of the Hastelloy X cladding of the one inch diameter fuel element has been conducted. The distortion of the fuel element is calculated from a projected five year swelling of the fuel slug which is assumed initially offset laterally in the cladding. The creep strain capacity of the cladding is found to be structurally adequate under the assumed loading criteria. Several additional loading criteria and possible structural relief mechanisms are herein proposed for further evaluation. (auth)

19025 (WANL-PR(J)-028) SUMMARY PROGRESS REPORT FOR THE CONTRACT YEAR 1963. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Oct 1963. 427p. Dep. NTIS $24.50.

Declassified 10 Sep 1973.

The NERVA design effort was concentrated on defining the configuration of the NRX-A reactor and its associated assembly and shipping equipment. Analyses of the NRX-A design and of the results of the KIWI B4A reactor tests established the need for redesign of the core periphery. This redesign necessitated changes to the assembly equipment. Following the redesign, instrumentation requirements for the initial test reactors were established and detailed reactor assembly procedure manuals prepared. The design and testing of major components progressed satisfactorily. (auth)

19026 (WANL-PR(J)-041) NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 January 1966-31 March 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Apr 1966. 155p. Dep. NTIS $10.75.

Declassified 11 Sep 1973.

A major event in the NERVA Program took place when the NRX/EST reactor was run at full power for the first time. This test was performed at the Nevada Test Site on 3 March 1966, and involved running the nuclear rocket engine system for 6 minutes—with 1½ minutes of the period at full power—before the run was halted because of a suspected anomaly. Investigation proved the suspected anomaly to be an instrument malfunction. The NRX/EST system was restarted and operated for an additional 15 minutes in engine mapping experiments at reduced temperatures as well as varying power and flow periods. Later, additional NRX/EST experimental plans were performed covering full power and temperature operations directed towards achievement of reactor endurance objectives. The NRX-A5 was assembled and shipped on 18 March 1966 by special train. The reactor and simulated shield were installed in an Aerojet-General supplied pressure vessel, similar to previous installations. No difficulties were encountered in shipment to the Nevada Test Site. Effort was then concentrated on NRX-A6 and XE-1 reactor components. Processing and fabrication of NRX-A6 fuel elements and NRX-A6 and XE-1 graphite components was initiated. All major components, such as the outer reflector and control drums, have been received or are in process. The definition of the design for the NR-1 Large Diameter Reactor was accomplished with the concurrence of Aerojet-General and SNPO. Preliminary reactor parameters included thermal power of 5000 MW, power density of 68 MW/ft, a fuel diameter of 55.8 inches and a fueled length of 52 inches. (auth)

19027 (WANL-PR(J)-047) NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, 1 October 1966 Through 30 September 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Oct 1967. 199p. Dep. NTIS $13.00.

Declassified 11 Sep 1975.

WANL effort has been devoted to various aspects of the planning, design, analysis, procurement, fabrication and testing, and support of the following reactors: NRX-A5, A6, A7, XECF, XE-1, XE-2, Phoebus-1B, Phoebus-2A, Pewee-1, and NR-1. The XE-1 reactor was assembled and shipped, sealed in shipping container with a helium atmosphere. It was stored at NRDS for 10 weeks before the container was opened preparatory to removal of poison wires and incorporation into the engine assembly. Approximately 45 grams of debris were found, which included pieces of NbC coating and evidence of hydrolyzed fuel beads. Some degradation of the reactor had occurred in storage, probably due to hydrolysis caused by moisture adsorbed on the inner reflector or other components after an initial sensitization by chloride material remaining on some fuel elements after completion of the manufacturing process. Further clean-up of the reactor is currently taking place, with vacuuming of fuel channels leading to an additional 16 grams of material. Upon learning of the 30 minute duration of NRX-A5 instead of the 40 minutes predicted from electrical corrosion test data, fuel production for NRX-A6 was terminated and a fuel assessment program was initiated with the objectives of achieving a fuller understanding of the relationship between electrical test results and reactor data, resulting in an improved electrical screening test, and developing elements capable of achieving the 60 minute full power design objective for NRX-A6. In December there was sufficient confidence that the above objectives had been attained and production to a new fuel specification began in January both at WNCO and Y-12. The NRX-A6 was assembled and following modifications of the shipping system to incorporate the clean air purge necessitated by the XE-1 data, shipped to NRDS. WANL effort in the Controls, Systems Analysis, Test Planning, Safety, Reliability, Test Operations and other areas is being expended in support of the XECF, and ETS-1 activation programs prior to initiation of the XE engine test operations. All XE pneumatic actuators have been procured and are undergoing minor modifications to resolve problems encountered in checkout. Planning and engineering efforts in support of the NERVA flight reactor have continued with a major program in fuel development aimed at the Phoebus-2 conditions (some 200°R hotter and an 80% increase in power density over NRX). Present plans call for this NERVA fuel to be tested in the LASL Pewee-1 reactor. (auth)

19028 (WANL-PR(J)-053) NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 January 1969 Through 31 March 1969. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Apr 1969. 136p. Dep. NTIS $10.00.

Declassified 11 Sep 1973.

Preliminary testing of the XE-PRIME reactor verified that it is ready for full power tests: The nuclear subsystem, the reactor controls and the reactor safety system performed satisfactorily. Significant effort was expended in analyzing the Phoebus 2A nuclear behavior because of the significance to R-1 nuclear design. Analyses provided an indication of core hydrogen worth, core temperature worth, and control drum-reflector temperature worth. Nuclear calculations have been initiated to evaluate the analytical models of this reactor. Fault tree and failure mode analysis techniques have been conducted to the critical component and major part level in support of design and flight safety programs. In fuel, the development has been focused on the PEWEE-2 fuel matrix and coating, with high expansion fuel as the prime effort. (auth)

19029 (WANL-TME-046) SURVEY OF RADIATION EFFECTS TESTING FACILITIES. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Apr 1962. 9p. Dep. NTIS $4.00.

A survey was made of test reactors in which radiation effects tests of interest to NERVA could be carried out. Besides availability, the requirements were: High fluxes (~10^{14} nV) for short times, ability to insert and remove capsules 2 inches or more in diameter during reactor operation. The NASA Plum Brook Reactor appears to be the most advantageous from the points of view of: Location, availability, flux, interest in NERVA programs and no change for work on NASA-sponsored contracts. Because of the urgent need for certain data the GETR trail-cable facility will be considered further. (LTN)

19030 (WANL-TME-306) NRX-A CORE ORIENTATION AND ELEMENT IDENTIFICATION. Guzek, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Apr 1963. 9p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The methods of fuel element identification and installed location in the NRX-A core are described, including partial elements at the periphery. (LTN)

19031 (WANL-TME-321) ASSEMBLY STANDS AND PROCEDURES, NRX-A AT WANL. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1963. 14p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The general guidelines for reactor assembly are: (1) Each assembly operation is provided with its own tooling to assure that parts are handled and placed securely, and held in their true design relationship during and after the assembly operations. Also, the assembly tooling provides access and support for personnel to perform the necessary guiding, assembly, instrumentation, test and quality control operations and (2) The operations are planned to run concurrently so that each item is at its intended place at the time it is required. The specific design guidelines for the planning and tooling of the assembly operations are: Permanent location of assembly tools and stands resulting in planned control and monitoring of all activities according to a preset plan and with orderly and planned flow of components and movement of personnel. Each assembly stand is separated from the sur-

rounding personnel platform to isolate it from the deflections, stresses and vibrations of the personnel platforms. Parts of the tooling and stands in contact with reactor parts are made of non-corrosive material to prevent contamination of the reactor. The lifting fixtures are designed with a safety factor of 10 based on the ultimate strength of the material. Each assembly stand and fixture permits quality control functions to be performed during and after each assembly operation. (auth)

19032 (WANL-TME-385) PYROLYTIC TUBE ANALYSIS. Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 48p. Dep. NTIS $5.50.
Declassified 11 Sep 1973.
A method of calculating the thermal stresses in a cylinder whose coefficient of thermal expansion, modulus of elasticity, and Poisson's ratio are different in the radial direction than in the tangential and axial directions is presented. This method is used to calculate the thermal stresses in the NRX-A core pyrolytic insulating sleeves. (auth)

19033 (WANL-TME-402) PRESSURE LOSS COEFFICIENTS FOR BASIC AND MODIFIED TIE ROD COMPONENTS. Foster, R. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Sep 1963. 37p. Dep. NTIS $5.00.
Declassified 10 Sep 1973.
Tie rod component pressure drop coefficients are computed from data obtained in tests in which gaseous hydrogen was used as the working fluid. Representative values of the coefficients are given. The effect of leakage flow on the performance of the centering bushing was investigated. The tests reported are results for representative test pieces. However, individual parts, as well as fits between parts, will cause deviations from the figures given. Since the coefficient for a circular opening is proportional to the fourth power of the diameter, small discrepancies in manufactured parts can result in large changes in the effectiveness of a particular component as a flow metering device. To obtain exact values for each assembly, it is necessary to test that assembly having the identical parts it will have in the eventual construction. This is especially important when considering split bushings. The coefficient can change appreciably for varying degrees of leakage through the split. (auth)

19034 (WANL-TME-536) STATUS REPORT ON THE DESIGN SIGNIFICANCE OF COMPONENT TESTS. Phillips, R. B.; Miller, A. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 33p. Dep. NTIS $4.75.
Declassified 11 Sep 1973.
The significance with respect to the NRX-A reactor design of various flow tests is discussed: fuel element orifices, the tie rod liner, a misaligned fuel element and support block, a lateral support seal at low pressure isothermal conditions, fuel element channels at simulated full power operating conditions, and control drum drive shaft impedance paths. (auth)

19035 (WANL-TME-539) METHOD OF STATISTICAL ANALYSIS OF THE EFFECTS OF MANUFACTURING, ASSEMBLY AND OPERATING DEVIATIONS ON OPERATING TEMPERATURES OF THE NRX-A CORE. Buskirk, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 79p. Dep. NTIS $7.00.
Declassified 11 Sep 1973.
The effect of various manufacturing, assembly and operating deviations within the NRX-A core are analysed in terms of fuel operating temperature resulting as a consequence of the deviations. This analysis is conducted for the full power, steady state operating conditions, i.e. 4090°R exit chamber temperature. The deviations considered are based on fuel element specifications and drawing tolerances. Manufacturing data were used when available. The temperature variations were treated statistically both with and without radial conduction. The end result is a curve of the most probable number of channels above any given temperature. The most critical areas of uncertainty are pointed out and recommendations for future work are made. It is concluded that the effects of the deviations assumed imply that an appreciable percentage of fuel channels operate above 4600°R (where weight loss by corrosion becomes significant) and smaller percentages operate above 4960°R (where extensive fuel migration occurs) and a still smaller percentage above 5500°R (where liner melting occurs) when the average exit chamber temperature is 4090°R. (auth)

19036 (WANL-TME-564) PRELIMINARY REPORT ON THE USE OF NITROGEN AND AIR FOR REACTOR SHUTDOWN. Kochka, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1963. 24p. Dep. NTIS $4.25.
Declassified 11 Sep 1973.
The effects of nitrogen and air coolants on NERVA reference fuel elements and fuel element constituents was studied. Post-reactor hot test operation was simulated by using sections from hydrogen tested fuel elements. Exposure at hydrogen corrosion test temperatures in excess of 2200°C increased the susceptibility of the element to attack by the coolant gases. In such cases, exposure to air at 200°C with as low as 20 ppm water caused the element to crack as a result of bulk volume changes accompanying the oxidation and/or hydrolysis of diffused uranium carbide. Air and/or water vapor were also observed to damage the niobium carbide liners at temperatures as low as 200°C and when present as impurities in nitrogen lead to a possible adverse effect on the liners at temperatures as low as 300°C. (auth)

19037 (WANL-TME-723) LINEARIZED GRAPHICAL FREQUENCY RESPONSE ANALYSIS OF THE TEMPERATURE CONTROL SYSTEM FOR THE NRX AND NERVA REACTORS. Stock, A. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Mar 1964. 28p. Dep. NTIS $4.50.
Declassified 11 Sep 1973.
A linearized graphical frequency response analysis of the temperature control system for the NRX and NERVA reactors was made. This study was undertaken to provide a check of the analog-computer results and to determine the possibility of improving the reliability of the control system by increasing the thermocouple time constant without incurring instability problems. The results indicated that stable operation is maintained even if the thermocouple time constant is increased by a factor of ten, thus permitting an improvement in the reliability of the system through the use of a more rugged thermocouple. The agreement between the analog-computer results and those obtained from the present analysis was very good. (auth)

19038 (WANL-TME-744(Suppl.1)) THERMAL ANALYSIS OF HIGH TEMPERATURE FUEL ELEMENT CORROSION TESTS. Guzek, J. C.; Bournia, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Aug 1965. 52p. Dep. NTIS $5.75.
Declassified 11 Sep 1973.
The results of a thermal analysis of the quality control, single element, corrosion furnace test are reported. Recently acquired information on the electrical resistivity of fueled graphite has led to new calculations of temperature distribution in this test. These calculations included the temperature distribution in the fuel element, the temperature distribution of the hydrogen coolant through the channels, and the flow rate and pressure distribution in each channel. The major conclusions that may be drawn from this work is that the new information on resistivity of fueled graphite results in substantially improved agreement between calculated and measured values in the corrosion test series. (auth)

19039 (WANL-TME-819) G-1 CORE ASSEMBLY VIBRATION TESTS. Summary Report. Ettenson, N. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 59p. Dep. NTIS $6.00.
Declassified 10 Sep 1973.
A test and analytical program was initiated to subject a reactor of the NRX-A design to an external mechanical vibratory and transient dynamic environment. Results of the first series of tests, called the Core Assembly Vibration Series, are described. The G-1 Core Assembly configuration, designated as ND-20101, consists of the reactor core, lateral support system, inner reflector and core support plate. In the case of the lateral and torsional tests, sinusoidal vibratory inputs were applied directly to the inner reflector. The dome end support ring was bolted to a heavy bed plate. In the axial vibration tests, sinusoidal vibratory inputs were applied at the periphery of the core support plate with the reactor suspended in the up-firing position. The lateral and torsional tests were performed concurrently and then, after a partial disassembly for inspection and rebuild to the axial configuration, the test specimen was vibrated axially. The main result of the test has been increased knowledge and confidence in the NRX-A design. The primary objectives of the test have been met, in that the mechanical bundling ability of the lateral support system has been verified; areas of possible design difficulty have been uncovered and have resulted in further test investigation; and resonance conditions and frequencies have been determined in the axial and lateral directions. Several more detailed conclusions are given. (auth)

19040 (WANL-TME-852) STRUCTURAL EVALUATION OF NRX-A2 CORE INLET BAND. Saccocio, R.; Swanson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 11p. Dep. NTIS $4.00.
Declassified 11 Sep 1973.

The core band is designed to provide a positive bundling load on the core at the inlet or forward end. Thus, the axial leakage gaps between the elements at the core inlet can be held to, and remain at, a minimum during assembly, handling, and reactor operation. The band also insures that the leakage gaps between the elements at the inlet end will always be less than, or equal to, the gaps in the remainder of the core — thereby increasing system stability against flow-induced vibrations. The core band has been evaluated with regard to its structural adequacy and capability to induce the desired preload pressure on the core when assembled by means of the procedure specified. The analysis shows that the NRX-A2 core band is structurally adequate for the worst condition, which occurs during shutdown. At this extreme condition, the band stress is 33,400 psi, which represents a maximum core bundling pressure of 38.6 psi and a band load of 2,240 pounds. The room temperature yield strength of the 5 Al-2.5 Sn titanium band is 95,000 psi, and its strength increases at lower temperatures. Tensile tests have shown the bands to be structurally adequate. The bands failed at the couplings under tensile loads of 4,190 and 6,260 pounds, respectively. Other tests have shown that the NRX-A1 core band will not fail under the most adverse conditions. The design of the NRX-A2 core band utilizes a double coupling at each joint which minimizes the flange rotation, does not allow relaxation of the core preload bundling pressure, and minimizes the stress in the joints. (auth)

19041 (WANL-TME-866) EXPERIMENTAL DETERMINATION OF THE EFFECT OF VARIOUS MISALIGNMENTS, CROSS FLOW, LEAKAGE, AND HEAT ADDITION ON FLOW CHARACTERISTICS OF NRX-A2 TYPE FUEL ELEMENT ORIFICES. Test Series FFL-6. Chronis, W. C.; Fix, H. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Jun 1964. 85p. Dep. NTIS $7.25.

Declassified 11 Sep 1973.

The variation of loss coefficient for various axial misalignments up to 27 mils is slight for the smaller size orifices. The variation increases as the orifice diameter increases. The variation of loss coefficient for a radial misalignment of 18 mils is slight for the smaller diameter orifices. However, the 70.0 mil orifice has an appreciable deviation at the lower Reynolds numbers. The variation of loss coefficient as a function of Reynolds number with heat addition shows an increase in the loss coefficient. The variation of loss coefficients for varying cross flows shows a slight difference for the smaller orifices and a greater difference for larger orifices because of the flatness of the cross flow curves. The variation of loss coefficients as a function of Reynolds number for flows affected by different bleed flows was negligible. The variation of loss coefficient for sealed and unsealed orifices was quite pronounced. The loss coefficient was definitely higher in magnitude for sealed orifices. (auth)

19042 (WANL-TME-878) NRX-A2 REACTIVITY AND SHIMMING. Hill, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1964. 76p. Dep. NTIS $7.00.

Declassified 11 Sep 1973.

The reactivity of NRX-A2 was established relative to that measured for the PAX reactor by a detailed inventory of the physical differences between the two reactors. The reactivity difference was calculated by applying reactivity coefficients to the mass differences, and by comparing transport calculations of the two reactors. The reactivity of NRX-A2 was found to be $0.74 ± .76 greater than PAX. In order to bring the NRX-A2 operating drum position to about 90°, tantalum carbide shims were placed in twelve additional multihole elements in NRX-A2. These shims, located in the F6 and H6 clusters of each sector are expected to give a reactivity reduction of about $.81. The predicted cold critical angle after shimming is 91 ± 10°. The reactivity of NRX-A2 was also derived relative to several KIWI reactors to further corroborate the inventories assumed for NRX-A2 and PAX and to verify the PAX measurements. Good agreement was obtained in these comparisons. (auth)

19043 (WANL-TME-896) EFFECT OF ORBITAL DESTRUCT OF NUCLEAR ROCKETS ON EARTH CONTAMINATION. Hargrove, H. G.; Trammell, M. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 31 Jul 1964. 146p. Dep. NTIS $10.50.

In the original concepts, the explosive destruct system would be designed to pulverize the reactor (particularly the graphite-uranium core) into small fragments capable of being consumed by ablation and oxidation during subsequent atmospheric re-entry. Recent studies have indicated, however, that no substantial degree of burn-up of NERVA fuel may be expected to occur during the re-entry process. Nevertheless, the explosive destruct scheme can accomplish dilution of the radioactivity contained in the unburned fragments by scattering the debris over large areas of the earth's surface, perhaps to the extent that statistically no human will receive an adverse amount of radiation. Also, the breakup of the reactor precludes the possibility of a water or earth impact nuclear excursion, a situation which might prove to be undesirable. An analytical approach has been developed for the determination of the magnitude of earth area contaminated by destruct debris. The tools developed include a 7094 digital computer program, NEFOD, which is used to calculate the fraction of an orbit traversed by a destruct particle before it impacts on earth. A second program, NURODAC, calculates the contaminated earth area and sets of error coefficients which can be used to calculate variations in earth contamination area as a function of destruct parameters. Some examples of typical error calculations have been included. Complete descriptions of the two computer programs are also included. (auth)

19044 (WANL-TME-928) LIFE QUALIFICATION TESTS FOR CONTROL DRUM PNEUMATIC ACTUATORS XE-1 ENGINE APPLICATION. Marttila, R. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Aug 1964. 9p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The requirements for a life test of XE-PRIME Engine Control drum actuators are defined. Vibrational forces (frequency, orientation and amplitude) are specified and involve cycling of a variety of conditions for 150 hours followed by a one hour, low temperature (385-405°R) test combined with specified vibratory conditions. Performance requirements for qualification are specified. (LTN)

19045 (WANL-TME-931) SUMMARY OF PROJECT NE 1840 STATUS REVIEW PRESENTATION AT SNPO-C, AUGUST 11, 1964. Kim, C-K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1964. 35p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

Soon after the initiation of the Project NE 1840 in May, WANL contacted LASL and discussed various features of PHOEBUS II reactor design. WANL effort in the NERVA II reactor sizing and design has been based on the following ground rules: Selection of the largest core diameter which still allows peripheral control as in NRX-A reactors; and conservative extrapolation of the present NRX-A reactor technology. The control drum reactivity worth versus core diameter as a function of void fraction was estimated on the basis of one-dimensional diffusion theory. A point check was made with two-dimensional analysis and verified. It is evident that the core diameter is strongly influenced by the void fraction. Fuel element size of NRX-A was retained except in the flow hole diameter which was increased to 0.115''. This resulted in a core void fraction of about 0.40. Next, selecting somewhat arbitrarily criteria of the minimum drum worth of about $9.00, as for the NRX-A reactor, the core diameter of 59'' was selected. Comparison of PHOEBUS II and NERVA II reactor characteristics are shown. Many of PHOEBUS II features are results of LASL's early study effort in a flexible reactor for the power range of 5000 - 8000 MW, such as 12-sided core shape, torsion bar lateral support spring, and nozzle chamber pressure of 625 psia, etc. Mechanical design effort has been primarily concentrated in areas of integrated reflector structure, lateral support spring and seal ledge, counterflow tie tube for cluster assembly, and core support plate and tie tube coolant mixing. (auth)

19046 (WANL-TME-934) AIR-HYDROGEN LOSS COEFFICIENT DATA CORRELATION FOR THE CONTROL DRUM-DRIVE SHAFT MODEL. Test Series FFL-8. Jacob, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Nov 1964. 70p. Dep. NTIS $6.50.

Declassified 11 Sep 1973.

A hydrogen flow experiment was conducted on the control drum-drive shaft model reported in WANL-TME-715, in order to determine how well hydrogen data and air data correlate. The purpose of hydrogen and air experimentation is to build up confidence and reliability that air flow tests can give accurate loss coefficients for hydrogen flow components. Using air, many problems and expenses associated with hydrogen are eliminated. The experiment was conducted at ambient temperature (514°-533°R), and for the most part, at inlet pressures ranging from 740 to 750 psig. The results showed excellent correlation for many of the loss coefficient calculations and it was found that the flow distribution through the control drum cooling holes is about equal as was reported in WANL-TME-715 for air. (auth)

19047 (WANL-TME-951) DOME END OUTER REFLECTOR SUPPORT RING COLLAPSING PRESSURE TEST. Morgan, L. P.

(Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 15p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

A static pressure test was performed to determine the capability of the NRX-A2 dome end outer reflector support ring (Z-ring) to withstand the pressure anticipated at the 100% power, 100% flow operating condition (45 psi) without developing excessive stresses of deflections. A pressure twice as high as the anticipated maximum pressure was applied on the outside surface of the cylindrical portion of the ring. Elastic instability of the test specimen was not observed, and the stresses obtained agree with calculated values. (auth)

19048 (WANL-TME-960) PLUNGER HOLE STRESS CONCENTRATION AND BINDING TEST. Final Report. Parker, W. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 32p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

Structural testing of an NRX-A1 inner reflector cylinder indicated deformations of sufficient magnitude to possibly interfere with plunger pin movements during reactor cooldown. Tests have therefore been performed to establish a relationship between plunger hole/pin radial clearances and the force required to overcome the interference friction should pin binding occur when a cross section of the inner reflector spring cutout region is subjected to simulated reflector static loading conditions. Results from these tests indicate that under a simulated reflector static pressure loading of 190 psig pressure, plunger forces of approximately 130 lb and 55 lb for radial clearances less than .001 in. and .0014 in., respectively, are required to overcome the interference friction resulting from pin binding. For radial clearances greater than .002 in., plunger hole deformations do not interfere with plunger pin movement. (auth)

19049 (WANL-TME-961) TEST REPORT ON A WANL RADIATION TEST OF NERVA COMPONENTS (GTR TEST NO. 12). Coombe, J. R.; Hornberger, D. W.; Loftus, W. D.; Simoncini, M. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 38p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

NERVA control drum actuator components, accelerometers, pressure transducers and graphite materials were irradiated in the GTR reactor to (3.4 to 34)10^{16} n/cm^2 and (4.2 to 4.7)10^{10} erg/g(C) gamma. Brief results are given on some terms; other items are undergoing post irradiation measurements. (LTN)

19050 (WANL-TME-962) PARTIAL LENGTH CORE ASSEMBLY STATIC TEST. Gyurek, J. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 14p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Static tests are conducted to determine the physical characteristics of the reactor lateral support system by applying a load, laterally, to the core. These tests are conducted on partial length core specimens, and the results extrapolated to obtain values for a full length core. The test reported was conducted on a specimen of updated reactor components, including an impregnated inner reflector, for comparison with previous tests. The full length core characteristics derived from the test data are spring rate, static friction force, static dead zone, static deflection, and natural frequency. Extrapolation from partial length core to full length values neglects effects of the tie rods. (auth)

19051 (WANL-TME-963) OUTER REFLECTOR SECTOR LENGTH VARIATION TEST. Krebs, A. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 10p. Dep. NTIS $4.00.

Stresses developed in the nozzle and dome end support rings as a result of tightening the tie bolts during reactor assembly were found to be relatively low. Although the magnitude of these stresses was affected by the differences in the lengths of adjacent sectors, they were not excessive for length variations as large as 0.020 in. The maximum stress for this condition was only 11,800 psi compared with a yield strength of 95,000 psi for the titanium support ring. (auth)

19052 (WANL-TME-964) RADIATION TEST OF SEGMENTS FROM THE NERVA DOME END SUPPORT RING (TEST 15/W301). Zorn, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 72p. Dep. NTIS $6.75.

Declassified 10 Sep 1973.

A radiation effects test was conducted on segments of the NERVA Reactor dome end support ring to evaluate performance under the combined environmental conditions expected in service. The test specimens consisted of six full size segments machined from an experimental support ring forging. A test fixture was designed and fabricated to hold three of these specimens during irradiation under typical load and cryogenic conditions; three samples were utilized as controls. The following investigations were made to evaluate integrity for NERVA applications: creep of the test specimens during irradiation under load at cryogenic temperature, hardness change, dimensions, dye-penetrant inspection, tensile tests to failure, and metallography. Although several anomalies were observed in the course of the post-irradiation examination, there was no significant evidence indicating potential problem areas with either the component design or the material of fabrication. (auth)

19053 (WANL-TME-993) FUEL ELEMENT: SUPPORT BLOCK FRICTION TEST. Leanza, E. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 8p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Differential thermal expansions between the fuel elements and cluster support blocks will occur during reactor startup. Since damage to these components could result during startup if high bonding forces developed, tests were performed to measure the breakaway friction forces required to produce relative motion under simulated reactor conditions. The results indicate that the breakaway friction forces that will be developed between the fuel elements and cluster support block during reactor startup should not be high enough to cause damage of these components. However, in long-life reactor tests where the fuel element-support block interface will be exposed to high temperatures for an extended period of time, relatively strong local bonding could develop. This bonding could cause coating damage if for any reason relative motions between the elements and block were found to occur during reactor shutdown and restarting. (auth)

19054 (WANL-TME-1021) DEVELOPMENT PROGRAM PLANS FOR REACTOR INSTRUMENTATION FOR CONTRACT YEAR 1965 (NE2460). Kalapaca, H. P.; Weldon, T. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 18p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

As required by the Contract Work Program, Development Program Plans for reactor instrumentation have been prepared. The transducer areas presently under development include: High Temperature Thermocouples, Pressure Transducers, Strain Gages, Accelerometers, and Electrical Cables. Development plans for each of the above transducers are presented. (auth)

19055 (WANL-TME-1022) EVALUATION OF FUEL PARTICLES. Boltax, A.; Brizes, W.; Feild, A.; Jacobs, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Oct 1964. 19p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Work has continued on the evaluation of qualification, production, and development type coated particles from participating vendors. Thermal migration testing has been conducted at 2300°C for four hours on all preproduction qualification and production lot samples. The development of a quantitative thermal migration test, based on micro-radiographic techniques, was described at the last Particle Fuels Working Group meeting. The results of this standard migration test on recent sample lots are shown. The quality of fuel beads has continued to be excellent on production lot samples of both General Atomic and Carbon Products fuels. The percentage of particles completely migrated after this test was generally within the 3 per cent maximum set forth in the specification. In anticipation of future requirements for higher fuel operating temperatures, some work was done in testing thermal migration characteristics at 2500° and 2600°C for exposures of $\frac{1}{2}$ hour. The data show that none of the samples, all of which passed the 2300°C-4 hour test, were able to survive either 2500° or 2600°C for $\frac{1}{2}$ hour with low percentages of total migration. The results of other types of tests, electron microscope studies and some development approaches are summarized. The mechanical strength of NERVA fuel is degraded by hydrogen corrosion and UC_2 hydrolysis. Some 16 fuel samples have been irradiated and then examined. Crack patterns are indicative of radial and tangential stresses from thermal gradients and residual stresses. (LTN)

19056 (WANL-TME-1071) NRX-A2 POST-OPERATIVE MECHANICAL COMPONENT EVALUATION. Karbowski, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 70p. Dep. NTIS $6.50.

Declassified 11 Sep 1973.

The post-operative evaluation of the NRX-A2 reactor showed that, with the exception of core corrosion, the reactor was in excellent condition. There was no repetition of the problems of

control drum rubbing, cracking of the thin webs of the beryllium sectors, flow hole blockage (debris), and outer reflector-pressure vessel interference as experienced in the NRX-A1 test. It is evident that the design modifications incorporated into the NRX-A2 were highly successful in correcting these problems. There were no visible signs of wear or damage to the outer reflector or shield components. The minor wear or damage that did occur was essentially limited to the inner reflector, core, and related hardware. This wear and damage was incurred during both the test and subsequent reactor disassembly. The inspection revealed that the major corrosion of the fueled elements was prevalent primarily on the ends of the elements and along the core peripheral surfaces. Corrosion of the unfueled graphite components was limited to the uncoated bores of both the unfueled elements and support blocks. An incipient interstitial corrosion pattern, observed on the majority of the fueled elements, appeared as a band across the midplane of the core. This pattern, however, had no discernable depth. Two instrumented unfueled central elements were found to be broken when the clusters were disassembled. All fueled elements were intact. Some difficulty was experienced in the remote disassembly of the cluster nuts from the core support plate. (auth)

19057 (WANL-TME-1072) FIRST SINGLE CLUSTER CORROSION TEST WANL HYDROGEN CORROSION TEST FACILITY. Foster, R. D.; Gilchrist, M. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Feb 1965. 39p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

There has been a Nerva Project interest in a facility to hydrogen corrosion test a complete cluster assembly of Nerva fuel elements at high temperature conditions by electrical resistance heating. The first complete cluster test was successfully conducted in a furnace system on November 24, 1964 with a power supply limited by the current carrying conductor. When the installation of a higher current capacity distribution system is complete, this test system will have the flexibility to accommodate a wide range of useful tests. The first cluster test (at 10,000 amperes and 20 volts), the solution to the problem of using graphite-to-graphite chucking contact for transmission of high electrical current to a cluster, and the solution to the critical problem of electrically insulating the metal internal part from its surrounding conducting graphite elements are described. The significance of this test is the demonstration of the feasibility that clusters or similar type assemblies can be tested at high amperage, a concept previously considered doubtful. The results indicate that no insurmountable difficulties are to be expected with cluster testing when the 35,000 ampere distribution system is installed. (auth)

19058 (WANL-TME-1075) NRX-A2 POSTMORTEM ANALYSIS. Downs, G.; Stancampiano, P.; Warner, P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1965. 71p. Dep. NTIS $6.75

Declassified 11 Sep 1973.

The mechanical performance of the NRX-A2 reactor is reviewed. The two main areas covered are data analysis and postmortem analysis of noncorrosive damage. The data analyzed were generated by transducers monitoring the core/inner reflector cylinder radial gap changes, tie rod loadings, and control drum torques. The data analysis of the power run, which considered both static and dynamic responses, indicated that the core grew thermally slightly less than would be expected from calculations based on measured temperatures and nominal material thermal expansion properties. It was evident that the core did not contact the inner reflector and remained essentially concentric with respect to it. There was evidence that at least one of the station 48 plunger pins stuck in the inner reflector cylinder during the power shutdown. The measured tie rod loads agreed reasonably well with predictions. The control drum torques were very small, peaking slightly at the initiation of scram. There was no evidence of large and deleterious vibration of the reactor and/or its components. In general, the NRX-A2 reactor performed extremely well structurally and survived the power test without serious mechanical damage. The following component damage occurred: bending of the aluminum barrel tabs at the forward end; removal problems with a few of the tie rod holders and cluster nuts at disassembly; two broken, unfueled 13-hole instrumented central elements; pushed out end plugs in most of the station 45 thermocouple elements; and buckling of the tie rod coolant gas thermocouple probes. Design modifications have been made in NRX-A3 to eliminate or minimize the occurrence of these problems. (auth)

19059 (WANL-TME-1135) HHT-7 FILLER STRIP CORROSION TEST RESULTS: BUILD NO. 1 TEST NO. 1. Cherish, P.; Painter, W. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1965. 61p. Dep. NTIS $6.25.

Declassified 10 Sep 1973.

Experience in reactor tests indicate that high temperature corrosion of graphite material in a hydrogen atmosphere will be a major factor limiting the life of current reactor designs. In order to increase the life of current reactors it is necessary to understand this corrosion phenomenon in conditions representative of the reactors. In an effort to study peripheral core corrosion, a test program was initiated to design, fabricate and test a small diameter filler strip test model having compound components representative of the current reactors. The results obtained from the preliminary tests show that the concept of using a small diameter core model with components representative of the reactors is feasible in demonstrating corrosion phenomenon in the peripheral core region, and that this program can provide some of the much needed qualitative information to evaluate peripheral designs by comparison with the NRX-A2 reactor configurations and also in advanced reactor design configurations. (auth)

19060 (WANL-TME-1150) STATUS OF HIGH TEMPERATURE THERMOMETRY FOR THE NERVA REACTOR. Hoppe, A. W.; Levine, P. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Feb 1965. 50p. Dep. NTIS $5.50.

The design of thermocouples to measure temperatures to 5000°R (2500°C) in carbon and hydrogen environments involves complicated selections of materials as well as optimum sizes of components. In addition to carburization which embrittles the sheaths, the melting points of the refractory metals are substantially reduced by the presence of carbon and possible formations of metal-carbon eutectic compositions. The hydrogen severely embrittles tantalum, and in addition, has been observed to affect the thermal EMF output of the couples causing increased errors in the high temperature measurements. Chemical and physical compatibility of the materials of construction are discussed, particularly, the combination of refractory metals and the oxide insulators. Besides basic materials considerations, programs for optimizing wire sizes and insulator dimensions have been developed. Tests on thermocouple assemblies point out the need for more fundamental testing to determine the optimum material combinations and specific environmental limits for a functional thermocouple. (auth)

19061 (WANL-TME-1173) CORROSION OF GRAPHITE SUPPORT BLOCKS. Lamartine, J. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 42p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

Since graphite reacts extremely rapidly with hydrogen at the temperatures and pressures of reactor operation, the support blocks for the NRX-A2 reactor were protected from hydrogen corrosion by a coating of niobium carbide applied to all exposed surfaces. As a part of an extensive quality control program, a section of one support block from each coating batch was corrosion tested in hydrogen at conditions approximating NRX-A2 operating conditions. The corrosion testing program is described and results correlated with nondestructive and destructive tests such as adherency tests, coating stoichiometry, coating discoloration, coating defects, and others. The results and data presented are confined to the information available at the termination of NRX-A2 support blocks evaluation. (auth)

19062 (WANL-TME-1181) EVALUATION OF THE FUEL ELEMENT EDDY CURRENT NONDESTRUCTIVE TEST SYSTEM. Cowfer, C. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Aug 1965. 29p. Dep. NTIS $4.50.

Declassified 11 Sep 1973.

The primary function of the Fuel Element Eddy Current Nondestructive Test System is to detect discontinuities or flaws in the graphite matrix of NERVA fuel elements. The system is used for the establishment of acceptance criteria as well as in the routine processing of fuel elements. The eddy current test technique is described and an evaluation of the test system presented. A brief analysis of the principles of operation of the system is included. The conclusion reached as a result of this evaluation is that the eddy current test system is both an effective production control method and an excellent means for maintaining a high level of quality control. (auth)

19063 (WANL-TME-1186) NRX-A6 PRESENTATION, JUNE 4, 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Jun 1965. 84p. Dep. NTIS $7.25.

Declassified 11 Sep 1973.

The design features in the NRX-A6 reactor will be fully compatible with the present test cell "A" facilities, the present NRX-A control drums, the control drum actuators, the pressure vessel and dome, and the nozzle. It can be tested in a shorter time and at less cost than a NERVA II reactor, and at the same time it will demonstrate technology which is fully scalable. The most important improvement is the elimination of the graphite inner reflector or barrel. This simplifies the reactor periphery and eliminates the barrel hold down spring system. The space gained permits using a thicker beryllium reflector or a larger core. Design studies have been confined to the thicker beryllium reflector, compatible with the present NERVA nozzle. The thicker beryllium permits future designs to move in many directions. Specifically it provides more flexibility for scaling the reactor size, flexibility for fixes of drum rubbing, more control span, and lower loading density or higher void fraction. With the elimination of the graphite barrel, the flat leaf lateral support springs now mounted on the barrel have been changed to coil springs in sealed cavities in the beryllium. This results in much greater flexibility in the design of the flow and pressure distribution in the core periphery. Since the springs are moved further away from the core, the control drum effectiveness is increased. Reliability is being improved by design simplification, elimination of limiting components, increasing the structural strength and allowing for thermal accidents which can occur during testing. At the same time design flexibility is being retained as far as possible so new solutions can be adopted, e.g., in the graphite corrosion problem. Further, the structural concepts adopted can be designed for a range of core diameters without major additional development effort. (LTN)

19064 (WANL-TME-1187) NRX-A4 PRIME ALTERNATES PRESENTATION, JUNE 4, 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jun 1965. 35p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

19065 (WANL-TME-1190) ISOSTATICALLY MOLDED P-03 GRAPHITE FOR LARGE STRUCTURES. Kachur, V.; Nicholson, H. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jun 1965. 74p. Dep. NTIS $6.75.

The fine-grained premium grade P-03 graphite was successfully fabricated by an isostatic molding technique, resulting in flaw-free stock 7 inches in diameter and 72 inches long. In this technique the combined raw materials (green mix) are shaped by packing into rubber molds. The molds are sealed and submerged under a fluid in a pressure vessel and hydrostatic pressure applied. The compacted mixture is then cured, carbonized and graphitized. Selected mechanical and thermophysical properties of this developmental material were evaluated for NERVA design purposes. The feasibility of producing a graphitized cemented joint equivalent in strength to that of the isostatically molded P-03 matrix is demonstrated. (auth)

19066 (WANL-TME-1193) UPGRADING OF SINGLE ELEMENT HOT HYDROGEN CORROSION TESTING. Pouchot, W. D.; Chi, J. W. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1965. 65p. Dep. NTIS $6.25.

Declassified 11 Sep 1973.

An analytical examination has been made of the Westinghouse practices and equipment used in hot hydrogen, single element, electrical corrosion testing of fuel elements. Means are suggested by which both the operational and reactor-like simulation aspects of these tests may be improved both at presently required testing temperatures and higher. Simulation of a reactor-like temperature distribution has two aspects. The first is determining to a better degree of accuracy the present electrical test distribution. The second is that of tailoring the distribution to a given reactor-like profile. Additional voltage and temperature measurements are suggested as an aid in clearing up the first aspect of the problem. Conceptual designs involving cold end electrical chuck position, changes in furnace thermal radiation shielding, and guard heaters are suggested as a part of the program to improve the second aspect of the problem. Procurement of an additional power supply is recommended to allow unimpeded implementation of the guard heater approach. In addition to arcing and reactor-like temperature simulation, an operational problem which looms at this time is a marginal thermal capacity in the exit gas heat exchanger and transition piece. With improvement in these three problem areas, the furnace and its auxiliary equipment appear to be capable of much higher temperature service than that currently required. (auth)

19067 (WANL-TME-1198) PAX CRITICAL EXPERIMENTS IN SUPPORT OF NRX-A4. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Aug 1965. 160p. Dep. NTIS $11.00.

Declassified 11 Sep 1973.

The PAX critical experiments in support of the NRX-A4 reactor, identified as PAX-B, differs from the PAX-A reactor only in that the outer reflector is made up of different sectors and five different control drums. After determining that the drum position for clean delayed critical and drum worths had not changed significantly from the last reactor, the emphasis was shifted to material worth studies. Reactivity differences between fuel elements made by Westinghouse Astrofuel and the Y-12 Facility at Oak Ridge were measured and the worth of negative shims at various points within the reactor was determined. The technique of using an external pulsed neutron source with the reactor to measure the prompt neutron decay constant was initiated. While the measurements to date are very preliminary in nature, the results show that the apparatus is adequate and that, with further study, the method can be used for various types of reactivity measurements. In support of the NRX-A3 power tests in Nevada, a power calibration has been made on the PAX-B reactor, which by extrapolation permits a measurement of the total integrated power of the test reactor. To accomplish this, the fission product activity of uranium-aluminum wire exposed in Nevada was compared with similar wires exposed in PAX-B. A calibration factor, K, was derived giving the ratio of the integrated power of the reactor run (in fissions) per fission in the test wire as determined by radiochemical measurements. Two shielding studies were performed. (auth)

19068 (WANL-TME-1201) EVALUATION OF OVER-TEMPERATURE TRANSIENT CONDITIONS OF THE NRX-A3 REACTOR. Sipe, F. A.; Watjen, E. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1965. 43p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

Tests conducted to determine the effects of a malfunction which occurred during a shut-down of the NRX-A3 reactor are described. The gas temperature in the annulus between the liner and the tie rod of the reactor core increased to an unusually high peak of approximately 2470°R and remained over 2000°R for eight seconds. It was suspected that these temperature transients had caused serious damage to the center element and related components. Thus it was necessary to determine the damage caused by the malfunction and to evaluate the effects and limitations of further reactor operation. Due to the urgent need for information, a coordinated effort was initiated to resolve the problem by simulation of the damage conditions which occurred during the malfunction and estimation of the effects of the damaged core components on the reactor behavior during the planned additional 15 minutes of operation. As a result of the first part of the test program it was determined that carbiding had taken place on the tie rod liner. The extent of this damage varied from slight carbiding to complete burn-out, depending on the applied time duration and temperature pulse. The second portion of the test concluded that the operation of the reactor, for an additional 15 minutes, was feasible even though the tie rod tube liner failed completely. The validity of this data was verified by the successful restart and operation of the NRX-A3 reactor on May 20, 1965. (auth)

19069 (WANL-TME-1202) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JUNE 21, 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1965. 44p. Dep. NTIS $5.25.

Declassified 11 Sep 1973.

Tests, mainly in support of the NRX-A4 reactor, involved core dimensions as a function of bundling pressure, high temperature statis and fatigue tests of fuel elements (above 4600°R the failure mode is plastic in nature, while below this temperature failures are brittle), core insulation tests (bowing as a result of a thermal gradient), support block strengths, friction tests, wrapper tests, etc. (LTN)

19070 (WANL-TME-1219) FULL CORE AXIAL INTER-ELEMENT IMPEDANCE TEST. Burack, R. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1965. 39p. Dep. NTIS $5.00.

Declassified 12 Sep 1973.

One of the main design considerations in the NERVA reactor program is the problem of corrosion of the fuel element surfaces. It is believed that this corrosion results from interelement gap flow, pressure distribution and element porosity characteristics. There are two types of interelement flow, axial and radial, each of which contributes to the total gap leakage. The effects of porosity and gap size as functions of temperature and bundling pressure are significant. The results of the EML-60 Core Effective Gap Tests that have been obtained to date are presented. The objective was to determine the effective axial core gap impedance and the effect of increased lateral bundling pressures

on this impedance. In order to attain this goal it was also necessary to determine fuel element porosity and core dimensional properties. Experimental measurements of (1) core diameter vs. bundling pressure, (2) fuel element porosity, and (3) inter-element axial flow rate and pressure distribution with both helium and nitrogen gas are presented. These results are now being used to verify and improve empirical and theoretical impedance relationships. (auth)

19071 (WANL-TME-1244(Rev.1)) RESULTS OF BETA BACKSCATTER DATA EVALUATION. Horton, W. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 20p. Dep. NTIS $4.00.

Declassified 12 Sep 1973.

A program to examine data generated by the Union Carbide Y-12 automated beta backscatter test equipment was initiated. This equipment is designed to determine the niobium carbide thickness of coated fuel elements. Replicate samples of different types of fuel elements were selected and processed as standard production elements with repeated beta backscatter determinations and metallographic observations of niobium carbide thicknesses obtained for each. The following summarizes the conclusions and recommendations based on an analysis of the data from this program. Beta backscatter calibration data can be expressed as a linear function between counts and log thickness only if calibration standards between 0.0 and 1.7 mils niobium are used. A discontinuity in the relationship between counts and thickness is observed between 1.7 and 2.1 mils. Therefore, it is recommended that calibration curves for production data be evaluated for standards having thickness values less than 1.8 mils such that an expression of the following form is derived: log thickness = a + b (counts). Previously a constant, 1.235, had been used to convert niobium thickness to niobium carbide thickness. This conversion was not sufficiently accurate to obtain agreement between the beta backscatter results and the metallographic results. An empirical relationship between beta backscatter and metallographic data led to a parabolic formula. It is recommended that this expression be used for conversion of beta backscatter data to niobium carbide thickness. Other, more detailed recommendations are given, especially with respect to precision and thickness limitations of the method. (auth)

19072 (WANL-TME-1245) NRX-A3 INSTRUMENTATION DISASSEMBLY AND POST OPERATIVE REPORT. Figenbaum, E. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 46p. Dep. NTIS $5.50.

Declassified 12 Sep 1973.

The disassembly and post operative examinations of NRX-A3 instrumentation were performed at the R-MAD area of NRDS. A total of 93.8% of the 292 installed sensors were operating following the conclusion of the reactor tests. The post-test electrical checks verified six sensor problems. Four of these failed sensors had been damaged during the WANL and NRDS assembly operations. No abnormalities were found during disassembly operations that were not previously known. A total of 11.4% of the installed sensors gave questionable data during a part of one or more EP tests or showed a resistance change greater than 2% during the EP tests. The post-test electrical check verified twenty (20) sensors with resistance changes greater than 2% that could have contributed to the sensors questionability of total performance. The WANL diagnostic sensor performances were very good in the NRX-A3 test series. The results indicate the strain gage type pressure transducers performed more reliably than the variable reluctance type. The majority of failed and questionable sensors were observed at the conclusion of EP-IV and post electrical checks. The effect of reactor over-temperature cannot be definitely established in all instances but the indication is this reactor condition had a significant effect on these sensors. There were also sixteen sensors reported with problems of erratic data, low or high readings, defective sensor or sensor resistance changes that could not be verified on post electrical checks or post operative examinations. It is not conclusive that there was anything wrong with these sensors during the reactor tests. (auth)

19073 (WANL-TME-1376) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JANUARY 28, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1966. 38p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

Tests in support of NRX-A4, NRX-A5 and NRX-A6 reactors involved fuel element development and testing, cluster tests, support block and other graphite components, tie rods, seals, etc. and various friction, flow impedance, corrosion, thermal and mechanical measurements on reactor components. (LTN)

19074 (WANL-TME-1432) WESTINGHOUSE ASTRONUCLEAR LABORATORY CONTRIBUTION TO THE TWENTY-SECOND HIGH TEMPERATURE FUEL COMMITTEE MEETING, 24–26 MAY 1966. Tobin, J. M. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1966. 20p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

The third reactor in the present NERVA series to be tested at full power conditions was NRX-A4. NERVA fuel elements are dispersions of pyrocarbon coated UC_2 fuel particles in extruded graphite shapes. They are 52 inches long, are of hexagonal cross section, and have 19 coolant channels running the length of the element. To reduce the corrosion effect of the hydrogen coolant on the graphite fuel matrix, the coolant channel surfaces (bores) and the external surfaces of the element at the downstream end are coated with NbC. The NRX-A4 core contained 1584 NERVA fuel elements of which 693 were produced at the Union Carbide Y-12 facility. Preliminary observations on the post-test condition of the fuel elements and fuel element weight loss can be reported now. The post test appearance of WAFF and Y-12 fuel elements was different. The WAFF elements displayed, in general: high weight losses; high pinhole density; a high incidence of large, localized, internal voids (corrosion pockets); moderate to severe surface corrosion; and moderate corrosion at the coated end. The Y-12 elements, on the other hand, showed variable weight losses and pinhole formation which were highly dependent on core radius, moderate surface corrosion effects, and more severe corrosion damage at the coated end. In both types, patterns of element fracture were observed which appeared to coincide with high weight loss and high pinhole densities. Five hundred twenty-eight elements were observed to be broken during core disassembly. Of the WAFF elements, 45.7 percent were broken as compared to only 9.5 percent of the Y-12 elements. A major cause of element fracture seemed to be localized pinholes and corrosion pocket formation which caused a general weakening of the elements. (auth)

19075 (WANL-TME-1437) GRAPHITE CORROSION IN THE NRX/EST REACTOR, JUNE 3, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 201p. Dep. NTIS $13.25.

Declassified 10 Sep 1973.

The rather serious effects of corrosion of fuel elements by the hydrogen propellant in the NRX-A4-EST endurance test are reviewed. The effects of pinholes, core position, temperature, and fuel element manufacturer on weight loss are presented. The resulting reactivity loss rate at full power is given for NRX-A3, NRX-A4-EST, KIWI-B4E and PHOEBUS-1A reactors. The corrosion of other graphite components is reviewed briefly. A mathematical model of the corrosion mechanism is derived. (LTN)

19076 (WANL-TME-1469) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JULY 7, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1966. 36p. Dep. NTIS $4.75.

Declassified 12 Sep 1973.

Tests were mainly in support of NRX-A5, NRX-A6, XE-PRIME and NR-1 reactors. They involved testing fuel element clusters at high temperature, corrosion tests on graphite core components, mechanical and thermal tests on graphite support blocks, seal tests and other miscellaneous tests. (LTN)

19077 (WANL-TME-1476) EFFLUENT STUDIES ON NRX/EST. Grandy, G. L.; Rymer, G. T.; Henninger, W. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1966. 57p. Dep. NTIS $6.00.

Declassified 12 Sep 1973.

Prior to each experimental plan of a given NRX reactor test series, a source term prediction of the fission product release expected is computed with a fission product inventory code, FIPDIF, which accounts for diffusional loss of fission products. The diffusional loss of fission products is a function of the temperature of the reactor core, the time at temperature, the integrity of the fuel beads, the integrity of NbC coolant channel coating, and the diffusion constants and activation energies of the various fission product nuclides. In addition to fission product activity released by diffusion, there is also the release, by the corrosive action of hydrogen on graphite, of fission products entrained in core material. The core material may consist of graphite, fueled graphite, or NbC channel coating. As a result of the effluent measurements made on NRX/EST, the following conclusions can be made: The activity levels found on filters from different sampling aircraft were vastly different, pointing to a need for obtaining a good integral sample of the entire effluent cloud; the presence of ^{99}Mo on the filter samples provides a corrosion

indicator; the measured fission product release values corrected for corrosion in both EP's were higher than predicted using NbC diffusion constants, indicating that the fuel elements had lost some amount of bore coating; the measured release values in EP-IV A even when corrected for corrosion, were higher than the maximum prediction (assumed due to excessive peripheral core temperatures); the radioactivity release due to core corrosion increased the measured values by nearly a factor of two in both EP's; the corrosion release did not perturb the ^{115}Cd release values significantly but caused marked increases for some of the low release nuclides; and the FIPDIF code in its present form is not adequate, since it does not account for the radioactivity losses due to core corrosion. (auth)

19078 (WANL-TME-1490) WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY EXPERIMENTAL PROGRAM, NERVA CONTRACT YEAR 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 26p. Dep. NTIS $4.50.

Declassified 12 Sep 1973.

Nuclear experiments which will be conducted during NERVA Contract Year 1967 are described. These experiments include measurements in support of NRX-A6, XE-1, and XE-2, and NR-1 critical mockup experiments using the FCX. These measurements have been planned and designed to provide the NERVA Program with experimental data for nuclear design, radiation and shielding analysis, analytical methods development, and the Nevada Test Operations. The first NR-1 critical mockup experiment will utilize the FCX with NERVA- and/or KIWI-type fuel depending upon the desired fuel loading and void fraction in the fuel with an NR-type reflector. Experimental information obtained from this FCX mockup will be used to specify the NR-1 fuel loading. The mockup will also provide preliminary dosimetry, drum worth, core reactivity and material worth data. The measurements planned in support of NRX-A6, XE-1 and XE-2 include power distributions, reactivity worths, individual control drum and drum bank worths, radiation and shielding measurements, as well as fuel reactivity check measurements with final design NRX-A6 and XE-2 fueled elements. (auth)

19079 (WANL-TME-1555) FUEL ELEMENT TENSION TEST RESULTS AT ROOM TEMPERATURE. Zibritosky, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1967. 26p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

The purpose of the fuel element tension tests described is to provide data on the axial strain required to produce fracture under bundling conditions. Previous analysis shows that element fractures may result due to the combined effects of bundling pressure, temperature differences between adjacent elements, differences in the coefficient of expansion between an element and its adjacent members, the coefficient of friction, and the extent of corrosion. The tests reported were developed employing friction lockup at room temperature to study the strain required to produce fracture. With this strain data and other information it is possible to analyze reactor conditions to predict the probability of mechanical failure of a fuel element. When fracture within an element occurs during a test, the strain in the element under friction lockup, beyond approximately 2 inches on either side of the fracture, is only slightly altered by the fracture. The strain, however, is altered markedly in regions up to 2 inches from the fracture. This was true for the friction lockup test where bundling pressures on the order of 950 psi were required to produce fracture. To produce fracture in 10-inch fuel element specimens at room temperature by friction lockup, it was necessary that the bundling pressures approach 950 psi and the strains in adjacent elements approach 2500×10^{-6} in./in. The range of fracture strains for Oak Ridge specimens was more uniform than for WANL specimens exposed to similar environments. Multiple fractures occurred only in corroded elements. (auth)

19080 (WANL-TME-1565) XE-1 NUCLEAR SUBSYSTEM, THERMAL AND NUCLEAR DESIGN DATA BOOK. Reese, J. C. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Apr 1967. 266p. Dep. NTIS $16.50.

The Thermal and Nuclear Design Data for the XE-1 reactor are presented. The material includes reactor design goals, limitations, and nuclear, thermal, radiation, and corrosion data for the XE-1 reactor. (auth)

19081 (WANL-TME-1569) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JANUARY 26, 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1967. 47p. Dep. NTIS $5.50.

Declassified 10 Sep 1973.

Miscellaneous tests in support of the NRX-A6, NRX-A7 and NR-1 reactors are reported, especially measurements on the permeability of fuel elements and its variation with temperature. Other fuel element development and evaluation tests and corrosion tests on graphite components are reported. (LTN)

19082 (WANL-TME-1585) HIGH TEMPERATURE THERMOCOUPLE QUALIFICATION TEST FACILITY: DESIGN VERIFICATION AND SHAKEDOWN TESTING. Ferris, J. R.; Malarky, J. T.; Zellner, G. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Jun 1967. 158p. Dep. NTIS $11.00.

Declassified 5 Sep 1973.

A facility for developing, calibrating and qualifying temperature sensing devices in a hydrogen environment at temperatures up to 5000°R and working pressures to 750 psig has been designed and operated successfully for a year. The vertical furnace of stainless steel structure, waterjacketed and featuring a top hinged closure, a 66-inch long hollow hairpin graphite heater element and a multi-layered radiation heat shield constructed of thin refractory metal sheet provides a housing for test pieces 60 inches in length and $1\frac{1}{4}$ inches in diameter. The furnace and its auxiliary equipment are described in detail. Performance, operational problems and projected advanced design and development programs are discussed. Operational procedures and specifications are included. (auth)

19083 (WANL-TME-1607) DEVELOPMENT TEST PROGRAM INTERIM PROGRESS REPORT FOR MARCH, 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1967. 34p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

Tests in support of NRX-A6, XE-2 and NR-1 reactors emphasized fuel element development, testing and corrosion studies. Other tests involved corrosion and permeability measurements on other graphite components, burst pressure test of flow screens, seal leakage, etc. (LTN)

19084 (WANL-TME-1626) FUEL ASSESSMENT PROGRAM, PHASE 1-1C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 31 May 1967. 132p. Dep. NTIS $9.75.

Declassified 10 Sep 1973.

The major objective of Phase 1-1C of the Fuel Assessment Program was to investigate the relative corrosion behavior in the electrical test of elements with high and low leak rates. Fuel elements from Y-12 had low leak rates prior to coating, while similar elements chosen from WAFF had high leak rates prior to coating. Thus, large differences in matrix leak rates were available for evaluation. Two groups of 34 elements were selected and divided into two lots. One lot from each source was coated, respectively, at Y-12 and WAFF. This type of division was made to determine effects of matrix leak rate as well as coating from two coating sources. The test plan was to evaluate the effect of large differences in the permeability of the elements with identical coatings. Similar groupings, with molybdenum overcoating, were also evaluated. It was concluded that niobium carbide coating and molybdenum overcoating each contributes to reducing the element leak rates measured at ambient conditions. Pre-corrosion test permeability correlated with mid-band corrosion data: Phase 1-1C non-molybdenum overcoated elements which had high leak rates also exhibited higher mid-band weight losses. With molybdenum overcoating, the corrosion performance of both high and low leak rate elements was improved. Mid-band weight losses were lower and significantly longer test durations resulted. The limited data does not permit the determination of a correlation between mid-band weight loss and leak rate for the molybdenum overcoated elements. The hot end weight losses of Phase 1-1C elements were linear with test time. The hot end behavior of WAFF and Y-12 matrix elements with and without molybdenum overcoating were not measurably different. Without molybdenum the elements coated at WAFF showed somewhat higher hot end weight losses than those coated at Y-12. (auth)

19085 (WANL-TME-1645) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON JULY 19, 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 Jul 1967. 48p. Dep. NTIS $5.50.

Declassified 12 Sep 1973.

Tests, mostly in support of the NRX-A6 reactor, involved filler strip corrosion, supports, support springs, friction measurements, creep measurements, fuel element development and evaluation tests, etc. (LTN)

19086 (WANL-TME-1652) RESULTS OF FURTHER BETA BACKSCATTER EVALUATION DATA. Horton, W. H. (Wes-

tinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Aug 1967. 25p. Dep. NTIS $4.25.
Declassified 12 Sep 1973.
With the beginning of the NRX-A6/2 production of fuel elements, WNCO introduced four general changes in the evaluation of niobium-carbide thickness by beta backscatter. The changes were a redesign of the beta backscatter probe to consider an aluminum encapsulated source rather than the stainless steel encapsulation, a new set of beta backscatter standards, due to changes in uranium loadings, a different functional form for the calibration curve, and a set of expressions for use in converting apparent niobium per beta backscatter to equivalent niobium-carbide as obtained metallographically. All data analyzed lead to the conclusion that probes with the new aluminum encapsulated sources have responses equally as effective as those with stainless steel encapsulation. (auth)

19087 (WANL-TME-1670) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON AUGUST 31, 1967. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1967. 87p. Dep. NTIS $7.50.
Declassified 12 Sep 1973.
Miscellaneous tests of fuel elements, clusters, and other reactor components in support of the NRX-A6 reactor are reported. (LTN)

19088 (WANL-TME-1798) RADIATION ANALYSIS. Volume V. Capo, M. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Jun 1968. 188p. Dep. NTIS $12.50.
Declassified 11 Sep 1973.
The Radiation Analysis of the NERVA I reactor and those major structural components defined as Engineering Critical Components (ECC) are presented. A chapter is devoted to the radiation analysis performed on the candidate designs for each ECC. These chapters include a summary and the radiation requirements as given in the ECC and an analysis section. This latter section includes the methods, key assumptions, analysis results and the pros and cons from the radiation standpoint of each of the designs being evaluated. (auth)

19089 (WANL-TME-1869) PEWEE I FABRICATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Oct 1968. 22p. Dep. NTIS $4.25.
Declassified 10 Sep 1973.
Fuel element production for the PEWEE I core included a number of successful manufacturing modifications: (1) the use of a 75% NbC/25% composite tip, (2) a high hydrogen/salt ratio chemistry for the standard high temperature NbC process (GED), (3) a new low temperature NbC coating using a methane gas stream additive as the source of carbon, and (4) fixture modifications to coat a new system of support hardware. The production history of the fueled elements and reactor support hardware for the PEWEE I core is summarized, with particular emphasis on the development and implementation of new or revised processing techniques and production schedule records. (auth)

19090 (WANL-TME-1909) PAX-GO APPROACH TO CRITICAL. Final Test Report. Rowland, J. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1970. 47p. Dep. NTIS $5.50.
Declassified 12 Sep 1973.
An experiment was performed to assist in the development of an approach-to-critical procedure to determine accurate criticality estimates from subcritical multiplication measurements during the shipping poison wire removal operation. This experiment will also be useful in selecting most suitable detector/source locations for startup operation. The experimental procedure consisted of subcritical inverse count rate measurements at several detector positions taken during one, two and three drum roll-out conditions. Utilization of centrally located sources (at the reactor midplane in the central cluster) resulted in an essentially linear inverse count rate versus number of poison wires remaining during the approach-to-critical experiment. A clear dependence of the apparent multiplication (detector response) to the source/detector and .est drum configuration was demonstrated. A detector placed at 90° from the test drum with a central source appears to give the single, most accurate estimate of the actual change in multiplication. (auth)

19091 (WANL-TME-1910) PAX-G0 CONTROL DRUM SPANS AND REACTIVITY COEFFICIENT MEASUREMENTS. Final Test Report. Rowland, J. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1970. 66p. Dep. NTIS $6.50.
Declassified 12 Sep 1973.
Core material reactivity worths and control drum reactivity measurements performed in the PAX-G0 reactor are compared with predictions calculated by using Westinghouse Integrated Standard Design Method (WISDM). Based on this comparison, a drum span normalization factor of 0.90 was generated and will be applied to future R-1 drum span calculations. Calculated material reactivity worths in ¢/kg as a function of radial position for uranium and carbon are in good agreement with the experimental measurements for these materials. However, the calculated niobium worth overpredicts the experimental curve by approximately 20 percent. The standard design method which preceded WISDM underpredicted the experimental niobium worth by approximately 20 to 30 percent. Consequently, an investigation of the niobium worth discrepancy has been initiated to resolve the inconsistency between calculation and measurement. (auth)

19092 (WANL-TME-1915) RADIATION ENVIRONMENT ON CHESH COMPONENTS. Final Report. Rankin, W. D.; Hill, D. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1970. 122p. Dep. NTIS $9.25.
Declassified 12 Sep 1973.
The PAX/R-1 reactor was utilized for measurements of the radiation environment at the mockups of the R-1 Cluster Hot End Support Hardware (CHESH). The results obtained include neutron flux densities obtained with sulfur (E > 2.9 MeV), U-238 (E > 1.5 MeV), bare and cadmium-covered Dy (E > 0.4 eV). Fast neutron dose rates from Phylatrons and gamma dose rates from CaF_2 thermoluminescent dosimeters and Bragg-Gray chambers were also determined. Experimental data are compared with analytical calculations obtained with the two-dimensional discrete ordinates transport code, DOT. An S_{12} angular quadrature was employed in the DOT code. The analytical model is based on the actual PAX-G1A reactor, operating at ambient conditions. Reasonable agreement between the calculations and experimental data was generally observed. (auth)

19093 (WANL-TME-2697) TRACK II: A COMPUTER PROGRAM FOR TRANSIENT THERMAL ANALYSIS OF FLOW SYSTEMS WITH MULTIPLE PARALLEL AND SERIES CHANNELS. Woods, M. D.; Agosti, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1970. 124p. Dep. NTIS $9.25.
TRACK II is a digital computer program for transient and steady-state thermal analysis of heat-generating solids of arbitrary geometry cooled by fluid flowing through multiple parallel or series channels. The hydraulic and heat convection calculations are coupled with finite element heat conduction calculations to determine coolant conditions and material temperature distributions in a single computation. The primary application is to perform detailed thermal analyses of nuclear reactor components such as the reflector, the control mechanism, and fuel cluster assemblies under various operating conditions. A key feature of the program is the versatility of the flow network. Two independent groups of coolant channels are permitted and the channels may be arranged in series and parallel combinations. Additional features include an option for interface conduction between components modeled separately and a method to accommodate the effect of fast neutron fluence on component temperature distributions. The formulation for the transient thermal calculations is presented and the calculational models discussed with emphasis on the application of the capability of TRACK II for thermal, hydraulic analysis of complex systems. The thermal analysis of the reflector system for the XE-PRIME NERVA reactor is presented as an example of this capability. Computer users information is presented, including program organization, input and output formats, CDC-6600 deck structure, and a sample problem. (auth)

19094 (WANL-TME-2719) REACTIVITY WORTH OF ISA MATERIAL IN THE PAX-G2 REACTOR. Final Report. Leamer, R. D.; Orvis, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1971. 68p. Dep. NTIS $6.50.
Measurements were performed to determine experimentally the reactivity worths of selected samples of the In-Place Shim Adjustment (ISA) materials, and the perturbation of that worth caused by support stem and propellant hydrogen. Three shim materials were investigated: HfO_2, TaC, and HfC. These materials were plated onto the outside of stainless steel tubes with nominal coating thicknesses of 3 mils and ½ mil. Measurements were performed at four different radial core locations. The reactivity worth of hydrogen was also measured at selected locations in the core. The hydrogen was introduced in the form of polyethylene "wires" of 80-mil nominal diameter with the polyethylene "wires" placed in the shim tubes and also in the central flow channels immediately surrounding the test locations. The experiments confirmed previous predictions that HfO_2 shim coating

reduces the effective reactivity worth of hydrogen relative to an unshimmed configuration more so than a TaC shim. With a $1.50 shim content distributed uniformly throughout the core, the average support stem hydrogen is reduced by approximately 14% with HfO_2 but only by 9% with TaC. Because TaC does provide a greater dry shim worth for a given thickness than HfO_2 and results in a smaller reduction of stem hydrogen, TaC was tentatively selected as the prime shim coating for the R-1 reference design. (auth)

19095 (WANL-TMI-293) DEBURRING OF LITHIUM HYDRIDE PELLETS. Schreiber, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Oct 1962. 13p. Dep. NTIS $4.00.

Three types of deburring operations were performed on different lots of Lithium Hydride (LiH) pellets. The purpose was to determine the ability of these operations to remove the unwanted flashing left by the press in the formation of the pellets. The pellets were tumbled in both soft and hard containers besides being vibrated horizontally between screening material. None of the techniques was completely effective although the vibrations produced the quickest results. An operation such as double disc grinding should be included in the pellet fabrication process. This could insure both flatness and parallelism of pellets and thereby avert difficulties in the performance of the reactor shield at a later date. (auth)

19096 (WANL-TMI-298) PARAHYDROGEN 7090 SUBROUTINES. Pierce, B. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Oct 1962. 7p. Dep. NTIS $4.00.

Fortran (IBM 7090) codes have been written to determine various properties of parahydrogen. The codes are in the form of Fortran subroutines and can be used as part of any Fortran program. The following properties may be obtained from the complete package for both liquid, gas and in some cases the two phase region: Specific Volume, Compressibility Factor, Thermal Conductivity, Specific Heat, Specific Heat Ratio, Enthalpy, and Viscosity. The subroutines are described. The effects of parahydrogen and dissociation have been included. (auth)

19097 (WANL-TMI-1164) ANALYSIS OF Be SAMPLES IRRADIATED AT THE GTR. Woodsum, H. C.; Planinsek, F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Jul 1964. 27p. Dep. NTIS $4.50.

Eight beryllium samples were irradiated in the Ground Test Reactor (GTR) Facility. Four of these samples were of high purity Be and the other four were of NERVA grade Be. A 512 channel analyzer in the Flight Safety Laboratory at WANL was used to measure the decay gamma spectra of these samples at various times after shutdown ranging from 8 days up to about 6 months. By using a vendor's activation rather than a chemical analysis, some 73 elements were included instead of the 12 originally considered. By considering more elements in the analysis, it was possible to include even those trace elements which, although low in concentration, are high in activation due to the special combination of nuclear parameters of high activation cross section and intermediate to long half life. This experiment points up the advantage of an activation experiment for determining trace quantities of elements in materials that do not themselves become very radioactive by exposure to high neutron flux. The main constituents which provided most of the activation in the samples irradiated at the GTR were Br and Au for shutdown times less than 8 days and Ta, Co58 and Ag-108 for longer times after shutdown. The experimental decay curves are fairly well approximated by calculations with the ACT II code when the more extensive vendor analysis is used as input. (auth)

19098 (WANL-TMI-1166) NRX-A2 TEST CAR ASSEMBLY EVALUATION. Farquhar, N. G.; Hughes, R. W.; Johnson, F. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Jul 1964. 84p. Dep. NTIS $7.25.

The presence of fire during the power tests conducted recently on Kiwi B-4D, and which limited the hot-run, has prompted a review of the NRX-A2 test assembly. The logical place where hydrogen leaks may occur is at interconnecting flanges and unions, as well as at all the penetrations used for instrumentation purposes. A quick check of proper leak detecting procedures and techniques to test the integrity of all connections present revealed that no cryogenic leak test exists prior to the installation checkout test. Leak detecting techniques are found less than desirable, since they consist of checks at ambient temperature only. For the long range approach to the problem, a series of steps have been considered, which involve mostly piping modifications to both the test car proper and the test cell "A." Finally, a seal test program that would certify all seals and unions used on NRX test assemblies has been discussed and found a must in developing the degree of reliability needed for NRX test applications. The test car process piping with associated valves and flanges provides approximately 34 points of potential hydrogen leakage (exclusive of instrumentation connections) involving seven different types of seals. In general, the seal applications utilizing temperature-actuated, pressure-actuated, and conoseal joints indicate a low potential for leaks. However, the following applications indicate a high leak potential: All ring joint gaskets, standard pipe threads—in check valves, "O" ring flange in emergency purge line, and valve stem packing in AVV-11. The success of a seal depends not only on the correct application of the sealing principle but to a great extent upon careful field assembly of the particular seal. (auth)

19099 (WANL-TMI-1185) ELIMINATION OF BINDING OF THREADED CONNECTIONS ON REACTOR AND SUPPORT EQUIPMENT. Aducci, S. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 19p. Dep. NTIS $4.00.

The causes leading to binding of threaded connections and the actions that are being taken, and must be taken, to eliminate seized threads between mating parts are described. A review of all threaded connections on reactor assembly tools and shipping containers has been performed and some major causes of thread binding identified as follows: Use of similar materials in mating parts, such as stainless steel, which are subject to galling; lack of conformance with specified requirements, such as chambers on bolt lead threads and countersinks on lead threads of tapped holes which lead to distorted threads; improper, or improper use of, plating or coating subject to chipping and cracking; and damaged and dirty threads resulting from improper shipping, handling and storage techniques. The principal causes of thread binding are listed and the actions being taken by the Reactor Design Section toward minimizing binding of threaded connections are described. Corrective actions to be taken by other responsible sections to reduce this problem significantly are recommended. A tabulation containing pertinent data on the threaded connections on Reactor Assembly Tools and Shipping Containers was prepared. The recommendations show the action already initiated on existing threaded connections. (auth)

19100 (WANL-TMI-1201) EXPERIMENTAL DETERMINATION OF THE VARIATION IN FLOW PARAMETERS FOR CROWNED AND STRAIGHT SPLINE COUPLINGS. Jacob, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 10 Aug 1964. 16p. Dep. NTIS $4.00.

Tests were conducted to determine the difference in flow-pressure drop characteristics between straight spline and crowned spline couplings. The purpose was to provide a means of correlating the test results obtained from tests on the control drum drive shaft model with the coupling in the reactors. The couplings tested were models of the actuator end control drum drive shaft coupling. They were machined according to Drawing No. 976D098, Revision D, with the exception that one of the models was machined with straight splines rather than crowned. The test results showed that the ratio of straight spline loss coefficient to crowned spline loss coefficient is 1.16, the straight spline loss parameter (loss coefficient divided by area squared) is 265, the crowned spline loss parameter is 375, and that the ratio of straight spline loss parameter to crowned spline loss parameter is 0.705. The flow area of the crowned spline was less than that of the straight spline at the minimum cross section of the spline. The area ratio (straight to crowned) was 1.279. (auth)

19101 (WANL-TMI-1212) HM04-A GENERAL LOSS COEFFICIENT AND FRICTION FACTOR PROGRAM FOR VARIOUS GEOMETRIES USING AIR OR HYDROGEN. Morrison, H. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Aug 1964. 15p. Dep. NTIS $4.00.

A simple FORTRAN program has been written to compute loss coefficient or friction factor for a given geometry using experimental data. Also the Reynolds number and Mach number are computed for the given conditions. The equations defining the calculated values are given. The experimentally measured pressures and pressure drops may be input in the units of measurement, i.e., in psi, inches of mercury, or inches of water. All readings are converted to psi within the program. If the geometry is one or more circular holes, a circular annulus, or a rectangular annulus, the program will compute the area and equivalent diameter given the necessary dimensions. Any other configuration must be designated by inputing its area and equivalent diameter. The working fluid may be either air or hydrogen. The properties of hydrogen are calculated from a normal (25% para-) hydrogen properties subroutine. Air is assumed to obey the perfect gas law and to have a specific heat ratio of 1.40. The viscosity of air is given by a least squares fit to data obtained from Hunsaker and Rightmire. The total mass flow through the system can be measured by a sonic or a reversible, adiabatic nozzle. Again the measured pressures can be input in experimental units, and

are converted to psi within the program. The mass flow equations are given. Temperature data must be input in degrees Fahrenheit and lengths in inches. The program computes the required data for any number of test points taken for a given geometry. Also different problems may be input consecutively. (auth)

19102 (WANL-TMI-1216) OPERATING INSTRUCTIONS FOR THE TIE ROD PIN ASSEMBLY TOOL, NT 600827. Zwillich, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 26p. Dep. NTIS $4.50.

The description and illustrations of operations necessary to assemble and disassemble the tie rod pin of the fuel cluster with the aid of the tie rod pin assembly tool are presented. It was prepared to serve as an operating manual for the tie rod pin assembly tool to be used during fuel cluster assembly and repairs. (auth)

19103 (WANL-TMI-1257) DISCUSSION OF DATA, EML-1, REACTOR ASSEMBLY AXIAL VIBRATION TEST, NOZZLE EXCITATION. Burack, R. D.; Ettenson, N. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Sep 1964. 10p. Dep. NTIS $4.00.

Data recorded during the nozzle flange excitation of the ND-20102 reactor are summarized. Frequencies of special interest are 62, 150, 400, 500, 1200 and 1700 Hz. Pressure vessel, outer reflector and core support plate exhibit acceleration magnification at 62 Hz. At 150 Hz the core motions are amplified. At 400 Hz, the pressure vessel, outer reflector and core are moving, exhibiting relative acceleration magnifications. The core support plate shows a resonance at 500 Hz. Other resonances occurring at 1200 and 1700 Hz require further study. (auth)

19104 (WANL-TMI-1258) EML-1 REACTOR ASSEMBLY AXIAL VIBRATION TEST CONDITIONS AND TRANSDUCER SUMMARY, NOZZLE EXCITATION. Ettenson, N. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Sep 1964. 4p. Dep. NTIS $4.00.

The nozzle flange excitation tests were concluded. The bearing chattering previously reported was greatly reduced with the installation of the control drum bearing preload springs. Although the chattering was greatly reduced, acceleration spikes were still in evidence. In order to investigate the effects of chattering on the outer reactor transducers, the control drums were clamped to the outer reflector. Control drum chattering was completely eliminated. (auth)

19105 (WANL-TMI-1260) REACTOR ASSEMBLY VIBRATION TEST INFORMATION FOR USE IN INTERPRETING NRX-A2 TEST DATA. Burack, R. D.; Ettenson, N. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Sep 1964. 2p. Dep. NTIS $4.00.

The important frequencies and lumped mass modes of vibration obtained during the ND-20102 reactor assembly axial vibration tests are summarized. Vibratory motions were imposed on the reactor at the nozzle flange and at the dome end flange of the pressure vessel. Significant motions were observed at approximately 50, 140, 200, 400, 500, 1200 and 1700 Hz. The components associated with these frequencies are: The natural frequency of the core support plate mass acted on by the spring rate of the core support cone and tie rods is 500 Hz. The resonant frequency of the outer reflector-core support plate combination acted on by the spring rate of the dome end support ring is 200 Hz. An amplification of the control drum axial vibration due to clearances and thrust bearing stiffness occurs in the frequency band from 100 to 200 Hz. Other control drum responses are indicated at approximately 350, 450, 900 and 1300 cps. The first tie rod lateral natural frequency, at ambient conditions, is 22 Hz. Higher tie rod frequencies are expected in the NRX-A2 test due to core pressure drop and thermal effects. System resonances were found at 130 and 400 Hz. The highest system input impedances occurred at 50 and 62 Hz for the axial vibration tests. All reactor components moved in phase with one another and with a magnification over that of the input. These high impedances are partially due to the simulated nozzle flange stiffness and can be expected to increase somewhat with the stiffer actual pressure vessel. (auth)

19106 (WANL-TNR-067) AERODYNAMIC HEATING AND OXIDATION OF GRAPHITE IN FREE MOLECULE FLOW REGIME. Hargrove, H. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1962. 76p. Dep. NTIS $7.00.

After reviewing graphite particle reentry heating and oxidation in the boundary layer continuum flow region, these problems are investigated in other flow regimes. During atmospheric re-entry at altitudes above 300,000 feet, the formation of a definable shock wave in front of the body (at least for the size particles being considered here) does not occur because of the large mean free path of the ambient gas molecules relative to the body size. Therefore, it is not difficult to see that a Scala type continuum flow analysis cannot be used to describe analytically the heating and oxidation of a small body throughout the entire re-entry from high altitudes. Moreover, it is apparent that the initial input parameters to any continuum flow analysis will depend on previous flight history. Consequently, other postulated aerodynamic flow regimes have been investigated, including the various types within the broad category of continuum flow, in an effort not only to reconcile the differences originally obtained between the analytical and the experimental results, but also to place the entire problem of re-entry heating, oxidation, and mass transfer of graphite particles on a more refined analytical basis. Of course, the sole objective of this comprehensive program is to provide the best possible input information for design criteria of an orbital destruct system. The scope of the material presented is limited to the atmospheric flow regime encountered by particles 1" and smaller in diameter at altitudes generally in excess of 300,000 feet. This regime is commonly referred to as the free molecule flow regime. Initial results are summarized. (auth)

19107 (WANL-TNR-072) EXPERIMENTAL STUDY OF THE RE-ENTRY OXIDATION OF NERVA FUEL. Bridges, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1962. 52p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

In an earlier report, a description was given of a preliminary experimental program in which the burnup of graphite particles was studied under simulated re-entry conditions. Since the publication of that report, a more intensive investigation of that subject has been undertaken with the twofold purpose to determine what theoretical model may be used to predict mass loss rates during re-entry and to develop, if necessary, an empirical equation to predict these rates; and to determine if mass loss rates for fueled graphite differ appreciably from those of unfueled graphite. The following conclusions may be made as a result of the present investigation: Scala's equation (diffusion controlled reaction) predicts the rate of graphite oxidation in the hypersonic continuum flow region within a factor of two. Scala's equation does not apply at velocities of below 6750 ft/sec nor above altitudes of 280,000 ft. The rates of graphite oxidation in fueled and unfueled graphites are essentially the same. (auth)

19108 (WANL-TNR-130) MECHANICAL PROPERTIES OF NERVA FUEL MATERIAL. Anderson, C. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Sep 1963. 54p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

Room temperature mechanical properties of NERVA fuel elements containing up to 444 mgU/cc were determined using full cross-section flexure and compression specimens and a limited number of tensile specimens and a limited number of tensile specimens machined from the interior of the elements. No difference in the flexure and compression strengths were found as a function of uranium loading for elements manufactured to WANL PDS 30021 product and ND10201 drawing specifications. The mean flexure strength of these elements was found to be 5200 psi. The mean compression strength was 11,000 psi. The mean tensile strengths, for elements containing 180 mgU/cc, were 2900 psi parallel and 1900 psi perpendicular to the extrusion directions. Differences in the flexure and tensile strengths measured are attributed partially to material differences between the exterior and interior of the element, but mainly due to internal stresses within the element. The flexure and tensile data were analyzed statistically using a method developed by W. Weibull. (auth)

19109 (WANL-TNR-131) THERMOPHYSICAL PROPERTIES OF NERVA REFERENCE FUEL. Gaal, P. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 60p. Dep. NTIS $6.00.

Declassified 10 Sep 1973.

Equipment and methods were developed for the measurement of thermal expansion and thermal diffusivity of NERVA fuel elements. The operating range of these instruments were from liquid nitrogen temperature to 3000°C for thermal expansion and from liquid nitrogen temperature to 2000°C for thermal diffusivity. Thermal expansion measurements were made on samples which varied from 0 to 444 mgU/cc loading at temperatures up to 2500°C. The mean coefficient of expansion (room temperature to 1900°C) was found to be 4.0×10^{-6} (unfueled) and 4.7×10^{-6} in./in. °C (444 mgU/cc) in the transverse direction and 2.7×10^{-6} (unfueled) and 3.7×10^{-6} in./in. °C (444 mgU/cc) in the axial direction. Thermal diffusivity was measured by pulsing a thin sample on one side with a laser and following the tem-

perature history of the other surface. Preliminary results were obtained at room temperature on fueled and unfueled graphite samples, and compared with results obtained on ATJ and pyrolytic graphite. (auth)

19110 (WANL-TNR-193) NERVA PROGRAM, NRX-A2 TEST. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1965. 395p. Dep. NTIS $22.75.

Declassified 11 Sep 1973.

The NRX-A2 test was the first integral reactor in the NRX-A series in which nuclear power generation and radiation environment were major factors. All of the NRX-A reactors are based on KIWI-B-4 design and are part of the ground testing and development of the nuclear reactor to be used in the NERVA engine. At design power, 1120 MW are generated, with the hydrogen entering the nozzle chamber at a mixed mean temperature of 4090°R and 560 psia at the design flow of 71.3 lb/sec. On the basis of a critical review and analysis of the NRX-A2 test data and observations, it is concluded that the test was successful in meeting its objectives as well as confirming the nuclear, thermal, flow, and mechanical design analysis methods. The reactor operated at sufficient power levels and duration to demonstrate mechanical and thermal performance. The duration of the run and power level presented an opportunity to observe the fuel element behavior under realistic conditions approaching an endurance test. The most serious corrosion problem occurred along the fuel element flats at the core periphery towards the hot end of the core. This corrosion was the result of hydrogen leaking in through filler strips and pyro-tiles, and contacting fuel at elevated temperature producing a characteristic striated pattern on the flats. In the few places where NbC coating was present on the periphery, corrosion was largely inhibited. It was decided, therefore, to coat the periphery of the NRX-A3 core with NbC. In addition, the periphery fuel will be kept cooler by increased flow of coolant using appropriate orificing. (auth)

19111 (WANL-TNR-223) NRX-A6 REACTOR, TEST ANALYSIS REPORT. Knecht, W. L. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1968. 799p. Dep. NTIS $43.00.

Declassified 10 Sep 1973.

The NRX-A6 reactor operated continuously (single cycle) for 62 minutes above 4100°R chamber temperature with a significantly lower than expected loss of reactivity thus demonstrating greater endurance than the design objective. Significant NRX-A6 performance included sustained operation for periods of time at various chamber temperature and power ranges. The best available data and calculation procedures were used to compute the operating data. The maximum operating conditions reached at any time were: 4600°R average fuel exit temperature, 4330°R chamber temperature, and 1199 MW power. A summary of major operating conditions of the NRX-A2 through NRX-A6 tests is given. Included are (a) times within various chamber temperature intervals, (b) maximum power and maximum flow rates, (c) number of shutdown cycles above 2500°R, (d) maximum chamber temperature ramp rates, and (e) total reactivity loss. The results of the NRX/EST and NRX-A6 tests were of particular significance since they demonstrated two major accomplishments of the NRX Technology Program. These were (1) stable transient and steady state operation by the NRX/EST breadboard engine and (2) endurance at rated conditions by the NRX-A6 reactor. Thus, the NRX program to date has demonstrated the availability of a significant part of the technology required for the successful design of the NERVA flight engines. The purpose is to present the test data that are most important from a thermal, hydraulic and nuclear standpoint, to describe the analyses that have been performed on these data, and to present the conclusions drawn from these analyses. (auth)

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Refer also to abstracts 17149, 17165, 17179, 17180, 17182, 17184, 17221, 17224–17228, 17230, 17234, 17461, 17725, 18822, and 19231.

19112 (ANL-75-19) REXCO-HEP: A TWO-DIMENSIONAL COMPUTER CODE FOR CALCULATING THE PRIMARY SYSTEM RESPONSE IN FAST REACTORS. Chang, Y. W.; Gvildys, [illegible]. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 120p. AT.

The hydrodynamic-elastic-plastic version of the REXCO code (REXCO-HEP, Release 2), which treats not only the hydrodynamics, but also the elastic and plastic deformation of the reactor materials is described. The basic equations and numerical techniques used in the REXCO-HEP code are described in detail, together with the assumptions and limitations of the mathematical model used in the analysis. The results of comparison of the code predictions with analytical solutions and existing experimental excursion data are also given. Input instructions and output options of the computer program are included. (auth)

19113 (ANL-75-32) FINAL REPORT FOR THE H3 TRANSIENT OVERPOWER FAILURE THRESHOLD EXPERIMENT. Wright, A. E.; Rothman, A. B.; Stahl, D.; Agrawal, A. K.; Dietrich, L. W.; Chen, S. S. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 55p. Dep. NTIS $5.45.

Test H3 was the first transient overpower failure-threshold experiment in TREAT to use irradiated fuel and to employ a TREAT transient shaped to produce sample-temperature distributions typical of steady state prior to the overpower excursion. A seven-pin assembly was tested within the Mark-II TREAT sodium loop. The experiment was performed successfully with satisfactory TREAT power transient and loop performance, and demonstrated the capability of intermediate-power EBR-II-irradiated fuel at low burnup (no central void) to withstand a mild overpower transient that terminated with fuel temperatures just short of the solidus without cladding strain. Calculated values of outlet coolant temperature and amount of molten fuel generally agree well with the test data. Posttest thermalhydraulic and mechanical analyses of the fuel pins are reported. Results of detailed nondestructive and destructive examinations of the preirradiated central pin and a fresh peripheral pin are presented. (auth)

19114 (ANL-CT-75-43) MODEL FOR ANALYZING FUEL-ROD BUNDLE FLOW BLOCKAGES. Sha, W. T.; Szewczyk, A. A. (Argonne National Lab., Ill. (USA)). Jun 1975. Contract W-31-109-Eng-38. 30p. AT.

A model for analyzing fuel-rod bundle flow blockages is proposed here and will be implemented into the THI3D computer program. This model is compatible with the lumped volume approach employed in all subchannel analysis. It uses the fluid dynamic concept of drag to obtain the wake pressures and the stagnation point solution to modify the incoming flow. The unique feature of the proposed model is its explicit approach which does not require the computer storage of full three-dimensional data arrays. Through its iterative scheme, where downstream effects are fed into the upstream incoming flow by adjusting the incoming flow to satisfy the boundary conditions through a type of shooting technique, the solution is obtained without large computer core storage requirements. (auth)

19115 (BAW-10103) ECCS ANALYSIS OF B AND W's 177-FA LOWERED-LOOP NSS. Jones, R. C.; Biller, J. R.; Dunn, B. M. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jun 1975. vp. Babcock and Wilcox, Lynchburg, VA.

The effectiveness for the ECCS for B and W's 177-FA Lowered-Loop NSS is shown to meet the five criteria of 10 CFR 50.46. A spectrum analysis is performed and the worst case is used to establish allowable linear heat rates as a function of elevation in the core. (auth)

19116 (CONF-740807-P1, pp 30-40) RELIABILITY AND TESTING CONSIDERATIONS IN THE DESIGN OF NUCLEAR REACTOR FILTRATION SYSTEMS. O'Nan, A.; Williams, R. P.; Goldsmith, J. M. (American Air Filter Co., Inc., Louisville, KY). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The high performance standards set by USAEC-DRL Regulatory Guides for nuclear reactor filtration systems pose difficult problems for on-site leakage tests. These problems are compounded by the crowded conditions inside reactor structures, and by the fact that, until recently, little consideration has been given by system designers to the needs of testing. Techniques for coping with testing problems on existing systems, and suggestions for improving the testability of future systems, are given. Test crew safety considerations are discussed, and a pair of easily portable contaminant generators is described. (auth)

19117 (CONF-740807-P1, pp 41-49) AEC REGULATORY VIEW OF THE RELIABILITY OF AIR CLEANING SYSTEMS IN NUCLEAR FACILITIES. Bellamy, R. R.; Zavadoski, R. W. (Atomic Energy Commission, Bethesda, MD). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Air cleaning systems in nuclear facilities can be divided into three categories: ventilation exhaust systems, containment atmosphere cleanup systems, and process offgas systems. These systems have been the subject of numerous reports, regulatory guides, discussions, and meetings. Some of the analyses have been critical of the operation and design of these air cleaning systems--in particular, the engineered safety features containment atmosphere cleanup systems. Although for the most part the criticism is applicable, and recognizing that there are a number of unresolved issues pertaining to gaseous waste management systems, there are data to show that air cleaning systems in use in nuclear facilities are performing their intended function. (auth)

19118 (CONF-740807-P1, pp 50-56) USERS VIEW OF THE RELIABILITY OF AIR CLEANING SYSTEMS IN NUCLEAR FACILITIES. Kovach, J. L. (Nuclear Consulting Services Inc., Columbus, OH). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The state of the art of air cleaning systems has advanced, but a wealth of knowledge did not result in a commensurate increase in the improvement of the design, manufacture, and operation of air cleaning systems. Often the developed data is not available or known to the designer, equipment supplier or operator. There are still systems installed where the equipment will operate under the specified criteria only when it is new and little thought is given to the subsequent maintainance and operating problems. The dissemination of available information to all of those concerned with the design, construction, installation, and operation of air cleaning systems through relevant standards, guides, etc. is unsatisfactory at the present time. (auth)

19119 (CONF-740807-P1, pp 59-93) CALCULATION OF THE RADIATION DOSE FROM AN UPSET CONDITION IN THE OFF-GAS SYSTEM FOR A BOILING WATER POWER REACTOR. Dyer, N. C.; Schultz, R. J.; Killian, E. W.; Baston, J. E. (Aerojet Nuclear Co., Idaho Falls, ID). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

A study has been made which considered the upset conditions to result in a rupture of the delay line or charcoal adsorber portions of the radioactive off-gas treatment system for a boiling water power reactor. Radiation dose calculations were made for an individual at a 300-meter boundary fence. The doses calculated were the whole body immersion dose and the thyroid, bone and lung doses due to inhalation. The relationship between the various operating and upset parameters of the off-gas system and the radiation doses were investigated. A semi-infinite cloud model with a ground level release was assumed. For a delay line rupture, the calculated gamma immersion dose varies from a high of 9 rad for a break at the condenser to a low of 0.2 rad for a break at the maximum end of a 300-minute delay line. The thyroid dose from inhalation of radioiodine was calculated to vary from 3 to 6 millirem for a delay line rupture and be 0.6 rem for a charcoal bed rupture. The highest gamma immersion dose from a charcoal adsorber bed rupture was calculated to be 1.5 rad for the low flow rate condition with either an ambient or chilled bed system. Curves have been constructed which show the variation of the calculated doses with the various input parameters. (auth)

19120 (CONF-740807-P1, pp 94-98) ENGINEERED-SAFETY-FEATURE AIR-CLEANING SYSTEMS FOR COMMERCIAL LIGHT-WATER-COOLED NUCLEAR POWER PLANTS. Burchsted, C. A. (Oak Ridge National Lab., TN). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Substantial improvement has been observed in the design and construction of ESF air cleaning systems in some of the newer power plants, as compared to earlier practice, but there is still much to be done. Adequate space must be provided for these facilities in the earliest containment and building layout, and system designers, equipment designers, and building layout engineers must give adequate consideration to easy access to facilitate maintenance and testing. Finally, constructors and utilities must provide for proper storage of critical components such as HEPA filters and adsorber cells during construction and during the period awaiting startup of the plant. (auth)

19121 (CONF-740807-P1, pp 99-124) VERMONT YANKEE ADVANCED OFF-GAS SYSTEM (AOG). Littlefield, P. S.; Miller, S. R.; DerHagopian, H. (Yankee Atomic Electric Co., Westboro, MA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Early in 1971 the Vermont Yankee Nuclear Power Corporation decided to modify the existing off-gas delay system to reduce the release of noble gas isotopes from its boiling water reactor. This modification included a subsystem for recombining the radiolytic hydrogen and oxygen from the reactor and a series of adsorber tanks filled with activated carbon to delay the noble gas isotopes from the condenser air ejectors. The off-gas system and its operating history from initial operation in November 1973 to the present time are described. Data are also presented on the measured dynamic adsorption coefficient of the ambient carbon subsystem. Laboratory adsorption tests were conducted on the carbon prior to AOG startup and the results are compared with the effective coefficients obtained under operating conditions. (auth)

19122 (CONF-740807-P1, pp 125-148) SAFETY EVALUATION OF BWR OFF-GAS TREATMENT SYSTEMS. Schultz, R. J.; Schmitt, R. C. (Aerojet Nuclear Co., Idaho Falls, ID). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Some of the results of a safety evaluation performed on current generic types of BWR off-gas treatment systems including cooled and ambient temperature adsorber beds and cryogenics are presented. The evaluation covered the four generic types of off-gas systems and the systems of five major vendors. This study was part of original work performed under AEC contract for the Directorate of Regulatory Standards. The analysis techniques employed for the safety evaluation of these systems include: Fault Tree Analysis; FMECA (Failure Mode Effects and Criticality Analysis); general system comparisons, contaminant, system control, and design adequacy evaluations; and resultant Off-Site Dose Calculations. The salient areas presented are some of the potential problem areas, the approach that industry has taken to mitigate or design against potential upset conditions, and areas where possible deficiencies still exist. Potential problem areas discussed include hydrogen detonation, hydrogen release to equipment areas, operator/automatic control interface, and needed engineering evaluation to insure safe system operation. Of the systems reviewed, most were in the category of advanced or improved over that commonly in use today, and a conclusion from the study was that these systems offer excellent potential for noble gas control for BWR power plants where more stringent controls may be specified -- now or in the future. (auth)

19123 (CONF-740807-P1, pp 228-231) GENERAL ATOMIC'S RADIOACTIVE GAS RECOVERY SYSTEM. Mahn, J. A.; Perry, C. A. (General Atomic Co., San Diego, CA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

General Atomic Company has developed a Radioactive Gas Recovery System for the HTGR which separates, for purposes of retention, the radioactive components from the non-radioactive reactor plant waste gases. This provides the capability for reducing to an insignificant level the amount of radioactivity released from the gas waste system to the atmosphere--a most significant improvement in reducing total activity release to the environment. (auth)

19124 (CONF-740807-P1, pp 302-316) COST OPTIMIZATION FOR BWR AND PWR OFFGAS SYSTEMS. Desai, A. M.; Stewart, J. E. (Cosmodyne, Torrance, CA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Technical aspects of the Offgas Systems for both Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) are well covered in many published articles. However, in very few cases, cost aspects of the Offgas Systems are discussed. Both technical and economic factors must be included in any evaluation of the system. Factors such as reliability, maintenance, regulatory codes, future needs and public relations should also be considered. Some cost optimization methods for the offgas systems are presented. Discussion is focussed more on the BWR systems as they are more expensive and larger in size. The PWR systems are relatively smaller in size as the activity reduction is achieved with processing of the cover gas compared to that of the air in-leakage (up to 40 times) in the BWR systems. (auth)

19125 (CONF-740807-P1, pp 389-400) VENTILATION SYSTEMS AS AIR CLEANING DEVICES IN NUCLEAR POWER PLANTS: EXPERIENCE AT PALISADES. Sullivan, T. J.; Murri, E. L. (Consumers Power Co., Jackson, MI). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Experience at Palisades has demonstrated the importance of designing, constructing, testing and operating the ventilation system from the viewpoint of airborne radioactivity control during both normal operation and anticipated operational occurrences. An item of particular concern was the difficulty in maintaining correct non-ducted airflow patterns. Inadequate preoperational testing and system balancing led to marginal ventilation system performance. This condition was further aggravated by extensive plant maintenance and construction activities and, in some cases, by a lack of administrative control. Following completion of construction of the radwaste addition, it was possible, with minor basic design changes, to adjust and rebalance the entire ventilation system, thus assuring control of airborne radioactivity. (auth)

19126 (CONF-740807-P1, pp 401-430) NUCLEAR POWER PLANT CONTROL ROOM VENTILATION SYSTEM DESIGN FOR MEETING GENERAL CRITERION 19. Murphy, K. G.; Campe, K. M. (Atomic Energy Commission, Washington, DC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The requirement for protection of control room personnel against radiation is specified in General Design Criterion 19 of Appendix A, 10 CFR Part 50. The evaluation of a control room design, especially its emergency ventilation system, with respect to radiation protection primarily consists of determining the radiation doses to control room personnel under accident conditions. The accident dose assessment involves modeling and evaluation of radiological source terms, atmospheric transport of airborne activity, and protection features of the control room ventilation system. Some of the assumptions and conservatisms used in the dose analyses are based on the technical review experience of existing or proposed control room designs. A review of over 50 control room designs has revealed a great variety of design concepts, not all of which seem to have been based on radiation protection criteria. A summary of the basic control room protection requirements, design features, dose acceptance criteria, and an outline of the methods used by the Regulatory staff for accident dose evaluation are presented. (auth)

19127 (CONF-740807-P1, pp 620-631) OFF-GAS FILTER SYSTEM OF THE SNR-300. Boehm, L.; Jordan, S.; Schikarski, W. (Nuclear Research Center, Karlsruhe, Ger.). Mar. 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The Reventing-Exventing-System of the German Liquid Metal Fast Breeder Prototype SNR-300 is described. After an accident with major damage to the core the ventilation valves are quickly closed. At the same time the blower of the reventing system evacuates the reventing gap up to a pressure difference of 2 mbar between the containment and the outer atmosphere. This pressure difference prevents a leakage from the containment to the outside. The revented gas is recirculated into the outer-containment. Leaks from the atmosphere and possibly from the inner containment into the reventing gap increase the pressure in the outer-containment. Therefore depending on the pressure build-up which is determined by the course of the accident, it is necessary to exvent the containment after several days. The exvented gas is filtered by a filter combination consisting of pre-filters, charcoal-filters and HEPA-filters. Because accidental sodium fires produce high concentrations of sodium oxide-aerosols this filter system must resist chemical aggressive aerosols. (auth)

19128 (CONF-740807-P2, pp 659-682) DEVELOPMENT AND PERFORMANCE EVALUATION OF AN IMPROVED STANDBY GAS TREATMENT SYSTEM FOR ENRICO FERMI, UNIT 2. Parish, H. C. (CVI Corp., Columbus, OH); Schuerman, L. E.; Siegwarth, D. P. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The Enrico Fermi Atomic Power Plant–Unit 2 utilizes two natural draft cooling towers. These large structures create the potential for entrainment of the stack effluent in a down wash from the leeward side of the cooling towers, thereby reducing the effectiveness of the stack. Thus, a stack of reasonable height would not be sufficient to secure compliance with 10 CFR 100 under design basis accident conditions. Detroit Edison evaluated three methods for further reducing the potential doses and hence complying with 10 CFR 100. The solution chosen by Edison was to develop a Standby Gas Treatment System of advanced design which could justifiably be credited with an iodine removal efficiency of 95 percent or higher (90 percent maximum was the AEC standard prior to the issuance of Regulatory Guide 1.52). A Standby Gas Treatment System, manufactured by the CVI Corporation, was chosen for this application. The CVI system features an all welded, submerged inlet carbon adsorber design which assures high performance by eliminating all elastomer seals and thereby, the chance for bypassing of the charcoal. In order to secure credit for higher iodine removal efficiency, system performance was demonstrated by testing a large scale system under simulated design basis accident conditions. The test program was conducted by the General Electric Co. at General Electric's Gas Technology Facility, Vallecitos Nuclear Center. The unit tested was a 400 cfm module supplied by the CVI Corporation which incorporated the same design features as the full scale unit. (auth)

19129 (CONF-740807-P2, pp 985-1002) ECONOMIC COMPARISON OF AN IMPROVED NUCLEAR FILTER SYSTEM CONSIDERING SPACE, OPERATION, TESTING, AND MAINTFNANCE COSTS. Edwards, J. R. (Flanders Filters Inc., Kingston, NC); Hickey, T. N. Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AFC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The development of an all-welded charcoal adsorber design for increased system iodine removal efficiency has provided certain other unique advantages of particular interest to nuclear power plant personnel involved in health/safety, operation, maintenance, testing and space allocation for nuclear filter systems. The design features providing these unique advantages have been refined and tested and are available and installed on operating reactors as the HECA filter system. Health/safety aspects of the system are improved through the use of a unique pneumatic conveying system which eliminates the need for entrance of maintenance personnel into the filter housing during removal and replacement of spent charcoal and; thereby, minimizes radiation exposure of occupational personnel. Operational and maintenance costs, after capital investment, for nuclear filter systems being of particular interest to utility operations management are compared with conventional iodine absorber systems. The material cost savings in charcoal replacement with the system can exceed capital investment costs for given operating conditions. Testing and retest for by-pass leakage location and correction experiences are described and comparisons drawn between the HECA system and conventional designs. Space allocation improvements for actual nuclear filter system installations are described using the HECA system in conjunction with 1500 CFM "Superflow" absolute filter modules. Features of the separatorless absolute superflow filter that com-

plement the like design features of the all-welded HECA charcoal adsorber are described and operational and test data are presented. (auth)

19130 (CONF-740807-P2, pp 1075-1077) HEPA FILTERS FOR OFF-GAS SYSTEMS OF BWR UNITS. Avery, R. (Cambridge Filter Corp., Syracuse, NY). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

An off-gas system for a boiling water nuclear power station (BWR) vents to the atmosphere gases which are generated or released as the water is used in the closed loop between the reactor and the turbine. The off-gas system itself is located in the return from the turbine to the reactor. From an environmental point of view the off-gases of major interest are radioactive Krypton and Xenon, Iodine-131 and Tritium. In addition, there are quantities of oxygen and hydrogen from the thermolytic decomposition of water. The primary purpose of the off-gas system is to contain or to delay the passage of the radioactive gases to the atmosphere until they have significantly decayed into nonradioactive daughters. Because of the purpose of the off-gas system, it must be protected as much as possible from any accidents which might damage it. One source of accidents requiring shut-down of the system has been explosions of various intensities caused by the uncontrolled recombination of hydrogen and oxygen to form water. In investigating these uncontrolled recombinations, different items have been listed as possible initiators of these events. One such item has been the HEPA filter used to remove airborne particulates from this off-gas. (auth)

19131 (CONF-740807-P2, pp 1078-1092) STUDY OF MOISTURE SEPARATORS FOR FINE PARTICLE WATER-AIR-STREAM SERVICE. Smith, W. L. (Mine Safety Appliances Co., Evans City, PA). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

The need to remove 1 to 10 micron water particles from an air stream prompted the search for, and evaluation of, commercially available moisture separators that could best meet this requirement. An environmental test facility was designed, built, and used to test water particle filtering performance. Additional testing was done using NBS dust and DOP smoke. Five different commercially available units were evaluated. (auth)

19132 (ERDA-tr-44) NUCLEAR POLLUTANT IN THE POST-ACCIDENT ATMOSPHERE OF A LIGHT WATER REACTOR (LWR) CONTAINMENTS (SURVEY AND STATE-OF-THE-ART REVIEW). Hosemann, J. P.; Jordan, H.; Schikarski, W.; Wild, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). Jun 1973. Translation of KFK-1800. 81p. Dep. NTIS $7.25.

A possible consequence of a loss-of-coolant accident at a large nuclear power station is the total or partial melting of the core. This in turn entails release of fission and conversion products into the reactor containments and via leaks to the atmosphere where they pose a radiation hazard. The activity inventory of a 1000 megawatt light water reactor (l.w.r.) is calculated and known attenuation processes that contribute to a reduction of airborne activity in the reactor containment after a hypothetical accident are reviewed. The calculation of the activity present at the time of the accident differentiates between fuel, bred fuel, fission products, activated structural material and activated coolant. The literature on attenuation processes reveals that the theoretical understanding of nearly all relevant elementary processes is incomplete. Particular importance is therefore attached to experimental findings. Nevertheless, a number of models that encompass several elementary processes judged most important have been developed and compared to large scale experiments that simulate post accident containment behavior. Most extensive work, both experimental and theoretical, appears to have been done on the reduction of airborne iodine and its compounds and here model theory comes within a factor of two of duplicating experimental results. In contrast, little evidence of work on the behavior of aerosols in the presence of the condensing water phase expected as a constituent of the post accident l.w.r. atmosphere could be found. In light of the number of elements that according to the calculations have radiotoxicologically important isotopes and appear as aerosols, this void needs to be filled for trustworthy accident analysis. (auth)

19133 (GA-A-13094) GCR ACCIDENT INITIATION AND PROGRESSION ANALYSIS. Progress Report for the Period February 1–June 30, 1974. (General Atomic Co., San Diego, Calif. (USA)). 8 Oct 1974. Contract AT(04-3)-167. 89p. Dep. NTIS $5.45.

Assessment of the safety of nuclear power plants and of the needs for safety research and development can benefit from the development of quantitative methods for determining the likelihood of accidents. The approach presented in this report is based upon probabilistic evaluation. With this method, the probabilities of postulated accidents are considered as well as the nuclear consequences, such as potential exposure of the public to radioactivity. Some of the anticipated benefits of this approach are guidance for research and development programs dealing with safety, enhancement of public safety for accidents not now emphasized, and reduction of the economic burden borne by the utility customer because of undue emphasis on other accidents. The techniques being applied in the study of gas-cooled reactors include the derivation of accident sequence diagrams, the assessment of hardware reliabilities, an accounting of human errors, the calculation of accident consequences, the computation of accident and consequence probabilities, and the consideration of public safety. (auth)

19134 (GEAP-20615) ESTIMATING THE RELATIVE PROBABILITY OF PIPING SEVERANCE BY FAULT CAUSE. Wilson, S. A. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Sep 1974. Contract AT(04-3)-189. 58p. Dep. NTIS $6.00.

A comprehensive list of fault causes and an estimate of the relative contribution made by each to the probability of severance in reactor primary piping is presented. Severance is regarded as the sudden failure of a pipe without prior detectable leakage, with either circumferential or axial opening of substantial area. A fault cause is an event in the course of design, fabrication or operation of the piping system which ultimately proves to be the cause of some fault contributing to piping severance. These faults are principally an increased actual stress, decreased critical stress for severance due to unfavorable fracture properties of the material, increased crack frequency or growth rate, and decreased crack detection capability. A premise of this study is that the relative probability of piping severance by fault cause can be estimated best by recognizing the physical conditions under which severance may occur. For reactor piping, these are assumed to be mainly the occurrence at the same time and place in the piping system of a large crack, and a stress normal to the crack high enough to exceed critical stress for the crack; but provision is also made for the inadvertent occurrence of a stress exceeding ultimate strength, so that no crack is needed for severance. A second premise is that all piping damage follows from oversights in design, fabrication or operation (herein called a "fault cause"), and that relating faults with causes both improves the estimate of probability of occurrence of the fault and suggests useful improvements in practice. (auth)

19135 (LA-5975-PR) HTGR SAFETY RESEARCH PROGRAM, JANUARY–MARCH 1975. Kirk, W. L. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1975. Contract W-7405-ENG-36. 62p. Dep. NTIS $5.45.

Information on HTGR safety research is presented under the following headings: fission product technology, primary code impurities, structural investigations, safety instrumentation and control systems, accident delineation, and phenomena modeling and systems analysis. (JWR)

19136 (NAA-SR-Memo-8972) SNAP 10A LAUNCH AND REENTRY HAZARDS DUE TO STEADY-STATE OPERATION. Alexander, R. E. (Atomics International Div., Canoga Park, Calif. (USA)). 1 Sep 1964. Contract AT(11-1)-GEN-8. 53p. Dep. NTIS $5.75.

The safety analysis performed in support of the SNAP 10A flight tests has included consideration of potential hazards due to quasi steady-state operation of the SNAP 10A reactor under accident conditions. Steady-state operation is considered possible, although highly improbable, following launch pad accidents that could occur during or after fueling of the launch and orbital stage vehicles. In the extremely improbable event that reentry aerodynamic and impact forces fail to render the core permanently subcritical, steady-state operation is again considered possible. Potential radiation hazards due to accidents of this nature are examined in this report. (25 references) (auth)

19137 (NAA-SR-Memo-11968(Rev.2)) DESIGN DESCRIPTION AND SAFETY ASPECTS OF THE SNAP TSF REACTOR. Donovan, E. J. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Aug 1966. 75p. Dep. NTIS $6.75.

Declassified 15 Jun 1973.

The maximum credible accident for the system is assumed to be

the rapid insertion of one of the scram drums after the remaining three drums have been fully inserted. The resulting ramp insertion of $1.80 of excess reactivity in one second results in a peak power of 500 megawatts and a total energy release of 23 megawatt-sec. All the fuel elements in the core reach the temperature corresponding to rupture (1450°F). The resulting release of hydrogen from the fuel elements causes rupture of the NaK system. In order to initiate this accident there must be a breakdown of system interlocks as well as violation of the established startup procedures. (auth)

19138 (NAA-SR-Memo-12114) WEIGHT AND POWER CAPABILITY PENALTIES ASSOCIATED WITH INTRINSICALLY SUBCRITICAL SNAP 8 TYPE REACTORS. Lamkin, D. E. (Atomics International Div., Canoga Park, Calif. (USA)). 10 Aug 1966. 31p. Dep. NTIS $4.75.

Declassified 9 July 1974.

Various reactor cores having the composition of S8DS are examined. Minimum weight configurations are determined for reactivity reductions of $0, $3, $6, $9, and $12 when the cores are immersed in water. The power capabilities of these minimum weight designs are examined. (auth)

19139 (NAA-SR-Memo-12205) EVALUATION OF FUEL ELEMENT MATERIALS FROM SNAPTRAN 1 AND 2. Graham, W. H. (Atomics International Div., Canoga Park, Calif. (USA)). 19 Oct 1966. 34p. Dep. NTIS $4.75.

Declassified 23 May 1973.

Results of the examination of reactor core debris from both the Snaptran 1 and 2 Power Transient Experiments are reported. Included in the debris were five intact elements from the Snaptran 1 Thermal Cycling Experiment, and several identifiable segments of fuel and cladding from the Snaptran 2 Destructive Experiment. Additionally, a considerable quantity of unidentified fragments were recovered from the disassembled Snaptran 2 core, and were pertinent to these analyses. Metallographic, electron microprobe, and chemical analytical techniques were the primary means of examination. (auth)

19140 (ORNL-TM-4979) MONTHLY HIGHLIGHTS FOR OFFICE OF NUCLEAR REGULATORY RESEARCH PROGRAMS AT OAK RIDGE NATIONAL LABORATORY. Fee, G. G. (comp.). (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 37p. Dep. NTIS $5.00.

Research highlights are briefly summarized for ten reactor-safety related programs being conducted for the Nuclear Regulatory Commission. (JWR)

19141 (SA-696-13-006) EXPOSURE MODEL FOLLOWING RESERVOIR IMPACT OF THE NASA SPACE STATION REACTOR POWER SOURCE. Lahs, W. R. (Atomics International Div., Canoga Park, Calif. (USA)). 13 Jan 1970. 16p. Dep. NTIS $4.00.

The reservoir contamination model which will be incorporated into the NASA Space Station Safety Evaluation Report is described. The long term integrated bone dose resulting from an instantaneous release of ^{90}Sr to the reservoir is concluded to be the controlling hazard. (auth)

19142 (TI-696-160-001) WATER FLOODING CRITICALITY STUDY FOR ZrH FLIGHT REACTOR. Anderson, R. V. (Atomics International Div., Canoga Park, Calif. (USA)). 29 Oct 1970. 6p. Dep. NTIS $4.00.

Five analytical criticality calculations were performed to study the effects of: (1) water reflecting only (no core flooding), (2) water reflection with 10 percent core flooding, (3) water reflection with 35 percent flooding, (4) water reflection plus complete core flooding, and (5) the negative reactivity feedback associated with rapid core expansion induced by a destructive transient. (auth)

19143 (TID/SNW-44) ANTI CRITICALITY POISON WIRE SYSTEM FOR NERVA. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1968. 68p. Dep. NTIS $6.50.

Declassified 7 Sep 1973.

The Anti-Criticality Poison Wire System (ACPS) is a safety countermeasure, the purpose of which is to prevent the occurrence of any radiological safety problems prior to start-up of the NERVA engine system. Since the NERVA engine will not have been fired prior to in-flight operation, it will contain no fission products and, hence, under normal handling and operational conditions, no radiation problems will be present. The only possible way that a safety problem could occur is if the reactor were to undergo inadvertent criticality prior to normal start-up. Malfunctions leading to control drum run out, propellant flooding, water immersion, or core compaction could result in reactor criticality. The function of the ACPS is to prevent criticality in the event any of the above accident situations arise. The ACPS consists of a multitude of wires each containing a neutron poison material. These wires will be placed within the core prior to shipment and will be withdrawn prior to reactor start-up. The ACPS will protect against criticality for conceivable launch pad accidents, but may not protect against high impact water immersion or core compaction which could result from a booster failure within a time period of about 70 seconds occurring shortly after launch. A backup explosive charge may be desirable to ensure a non-critical configuration. (auth)

19144 (WANL-TME-721) NRX-A2 FLOW-LOSS-ACCIDENT ANALYSIS. Gurski, P. S.; Rovnak, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Mar 1964. 75p. Dep. NTIS $6.75.

Declassified 12 Sep 1973.

An analog computer study of the transient behavior of the NRX-A2 reactor system following a liquid-hydrogen flow loss upstream of the mixing chamber during operation at high power was performed to determine whether and how soon the tie-rod, core-inlet, and nozzle-chamber temperature constraints would be exceeded. In addition to determining the severity of the flow accident, an analysis was made of the feasibility of protecting the reactor from thermal damage by controlling the stem position of the mixing-chamber gaseous-hydrogen inlet valve (PCV-41). This scheme was based upon preliminary test results obtained at NRDS which indicated that if gaseous hydrogen were introduced into the mixing chamber after an upstream flow loss, the liquid hydrogen content of the mixing chamber would be displaced, thus temporarily restoring liquid flow to the reactor. Analog models of the Test Cell "A" facility feedsystem and the NRX-A reactor heat transfer and hydraulics were coupled with models of the neutron kinetics and the power and flow controllers to obtain an integrated NRX-A2 system simulation. A pressure controller was used in the analysis to control the stem position of valve PCV-41 but no special effort was made to optimize its response. The thermal transients resulting from the loss of flow were analyzed for a period of approximately 10 seconds following the accident which is approximately the time required to expel the liquid hydrogen from the mixing chamber. It was concluded that the NRX-A2 reactor can be initially protected following a flow loss by controlling valve PCV-41 so as to displace liquid hydrogen from the mixing chamber and temporarily restore flow to the reactor. It is recommended: (a) that a controller be designed, implemented, and tested in the Test Cell "A" facility to provide position control of valve PCV-41; (b) that a nozzle-inlet-pressure controller be considered for this purpose; and (c) that further analysis be performed to determine the subsequent cooling required to protect the reactor following expenditure of the residual liquid hydrogen in the feedsystem. (auth)

19145 (WANL-TME-1468) NERVA SOURCE TERM ESTIMATES. Presentation at Cleveland, 1 July 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1966. 120p. Dep. NTIS $9.00

Declassified 12 Sep 1973.

Estimates of fuel element corrosion and radioactive effluent emission from NERVA reactors were reviewed. The hazard at large distances is regarded as not from the direct gamma radiation, but from the dose of radioiodine to the thyroid from cow's milk and inhalation. It is concluded that NERVA reactor tests should only be run under the most favorable meteorological conditions. Methods of reducing radioactive effluents by fuel element development and scrubbing the exhaust are being investigated. (LTN)

19146 ARCHITECT/ENGINEER'S APPROACH TO AS-LOW-AS-PRACTICABLE IN OPERATIONS. Edwards, C. W.; Gutwein, E. E. (Gilbert Associates, Inc., Reading, PA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 28(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19147 MAINTENANCE TRAINING: ITS IMPACT ON AS-LOW-AS-PRACTICABLE. Motl, G. P. (NUS Corp., Rockville, MD). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 28-29(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19148 AS-LOW-AS-PRACTICABLE RADIOACTIVE GAS RELEASES FROM POINT BEACH NUCLEAR PLANT. Brown, L. E. (Wisconsin Michigan Power Co., Two Rivers, WI). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 30(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19149 OPERATIONAL–TECHNICAL DESIGN OF REACTOR PROTECTION SYSTEMS IS EXPLAINED USING A NUCLEAR POWER PLANT WITH BOILING WATER REACTOR AS AN EXAMPLE. Preusche, G. (Kraftwerk Union A. G., Frankfurt am Main). Energ. Tech.; 25: No. 9, 231-236(Sep 1973). (In German).

Although nuclear power plants have shown safe operation, still in their design all conceivable accidents must be considered. Therefore a reactor safety system is provided which initiates promptly suitable safety measures. The physical variables from which the safety system derives criteria for the automatic operation of safety measures were separated into three groups according to the types of measurements used in the determination of incipient accident conditions. The advantages and disadvantages of each group were discussed. The most important conceivable accidents in boiling water reactors were outlined and the process variables initiating suitable safety measures were indicated. (tr-auth)

19150 A NUMERICAL ANALYSIS METHOD FOR SPACE-DEPENDENT FAST BREEDER REACTOR CORE DYNAMICS AND COMPUTER CODE SPEC-FR. Yoshikawa, H.; Wakabayashi, J. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy). Tech. Rep. Inst. At. Energy, Kyoto Univ.; No. 153, 1-50(Oct 1971).

A numerical calculation method for a mild power excursion accident in the sodium cooled fast breeder reactor considering space-dependency of few-group neutron fluxes, various temperatures and void ratio distributions is proposed, and the FORTRAN computer code SPEC-FR is also developed based on that method. The neutron dynamics are solved by a quasi-static approach using the modified Helmholtz modal expansion method. Thermo-hydraulics for a typical single channel are solved by using the momentum integral method. Although some simplifications are made for treating sodium two-phase flow dynamics, the method is considered to give the first order approximation for sodium void behaviors sufficiently. The numerical examples by the code SPEC-FR are also mentioned. They show that the code would give detailed reactor power excursion behavior with reasonable computer time. (auth)

19151 PRESSURE-RESISTANCE TEST OF PCPV WITH A 1/30 MODEL. Isohata, O.; Tanaka, N. (Shimizu Construction Co. Ltd., Tokyo (Japan)). FAPIG (Tokyo); No. 69, 40-41(May 1973). (In Japanese).

Three $\frac{1}{30}$ scale models of a reactor PCPV were prepared. They contain a main cavity and six circular cavities. Materials tested are gypsum concrete and microconcrete. The cavities are made of rubber, to eliminate the contribution of liner strength to the strength of the models. Pressure testing was carried out using water, and prestressing was introduced with PC steel rods and wires. The test procedure was as follows, (1) pressurizing up to design pressure and return, (2) pressurizing up to initial cracking and return, and (3) pressurizing up to rupture. The initial cracking took place at about twice design pressure and the eventual rupture at 3.3 times the design pressure. Cracks first appeared on the top slab radially, then longitudinal ones followed in the wall; the rupture eventually took place on the top slab by shearing. Cavity arrangement has a large influence upon the mode of rupture. The maximum deformation reached about 50 times the deformation at the design pressure, and it was found that the plain concrete has sufficient strength. (JA)

19152 APPARATUS FOR COOLING A REACTOR VESSEL IN CASE OF ACCIDENT. Inoue, M. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1973-18437/B/. 15 Mar 1968. 3p. (In Japanese).

The present invention relates to an apparatus which absorbs heat in a nuclear reactor when an accident occurs. The apparatus consists of cooling pipes placed inside a reactor chamber and thermally insulated by a wall from the pressure vessel which contains nuclear fuels. The insulating wall is constructed to be easily eliminated or broken when an accident takes place. The cooling pipe is a double-pipe structure having an inner pipe and an outer pipe. A coolant below 0°C such as an aqueous solution of ethylene glycol constantly flows inside the inner pipe. The space between the inner and the outer pipe contains water which is frozen by the low-temperature coolant in the inner pipe. A buffer such as polyethylene foam is contained between the two pipes to prevent the fracture of the pipe by expansion on freezing. A pressure proof valve is provided along the outer pipes to let the overheated vapor out into the reactor chamber to prevent break-down of the pipe when a portion of the cooling pipe is overheated and the inside pressure greatly increases. (JA)

19153 DEVICE FOR THE DEGASIFICATION OF LOW-LEVEL RADIOACTIVE CONDENSATES IN NUCLEAR POWER PLANTS. Gross, R.; Plotz, J. (to Kraftwerk Union A. G., Muelheim an der Ruhr (F. R. Germany)). German Patent Document 2164574/B/. 22 May 1974. 6p. (In German).

One of the characteristic features of the degasifying facility is the feed of secondary condensates under higher pressure and higher temperature into the low-level radioactive main condensate which is in a collecting tank below the condenser. Several degasifying channels with inlets for the condensates are arranged in the upper part of the tank. The lower part of the condensate-collecting tank, however, is specifically constructed as a decay line. Here the condensate which is flowing off via the overflow and a discharge chute is forced on a meandering line by means of separating walls with perforations in reversed order towards each other. (auth)

Reactor Theory and Calculation

19154 (JAERI-M-5916) SLAROM: A CODE FOR CALCULATION OF A HETEROGENEOUS CORE IN FAST REACTOR. Nakagawa, M.; Tsuchihashi, K. (Japan Atomic Energy Research Inst., Tokyo). Dec 1974. 32p. (In Japanese). INIS. NTIS (US Sales Only) $4.75.

The SLAROM code has been developed for the heterogeneous cell calculation and one dimensional calculation in a fast reactor. This code uses the 70 group cross section set, JAERI-FAST set, as library data. The heterogeneity effect of the effective cross sections in each region of a cell is taken into account on the basis of the rational approximation. In the cell calculation the integral transport equation is solved by the collision probability method in slab and pin type lattice cells. The leakage from the system is considered in the absorption term by adding DB^2, where B^2 is buckling. The cell averaged effective cross sections and diffusion coefficients (including the anisotropic diffusion coefficients defined by Benoist) are written in the PDS file, which is used as input data to the one dimensional diffusion calculation. Therefore, these calculations can be performed without any intermediate hand work. Moreover since all the input data is written in a free format, it will be easy to prepare the input data. (auth)

19155 (JAERI-M-5940) HETERO: A SUBROUTINE FOR CALCULATION OF RESONANCE HETEROGENEITY IN FAST REACTOR LATTICE CELL. Ishiguro, Y. (Japan Atomic Energy Research Inst., Tokyo). Dec 1974. 22p. INIS. NTIS (US Sales Only) $4.25.

A brief description is given of the general property of the collision probability in plane geometry. A discussion is made on the asymptotic behavior of the resonance flux at the black limit as the resonance cross section tends to infinity. From the asymptotic behavior, a multiregion equivalence relation is derived on the analogy with the Wigner rational approximation for the collision probability. It is shown that the present formulation tends to the two-sided E_3 formulation of Meneghetti, for the special case where all the fuel plate sizes and the compositions of fuel regions are the same. Following the method derived, a subroutine HETERO was developed for calculating the resonance heterogeneity effects in fast reactor lattice cells. A brief description is given of the use of the subroutine developed. (JA)

19156 (JEN-295) PROGRAMMING A DATA ACQUISITION SYSTEM FOR SPECTRAL AND CORRELATION ANALYSIS OF RANDOM PHENOMENA. Zurro Hernandez, B.; Perez-Navarro Gomez, A.; Fernandez Marron, J. L. (Junta de Energia Nuclear, Madrid (Spain)). 1975. 50p. (In Spanish). Dep. NTIS (US Sales Only) $5.50.

Theoretical foundations of spectral and correlation analysis of random phenomena are discussed and the software for this analysis implementation in a general data acquisition system with a variable number of signals is developed. Applications to known functions and thermocouple signal fluctuations in a liquid sodium loop are included. (auth)

19157 (ORNL-tr-2971) FEM2D: PROGRAM FOR SOLVING THE TWO-DIMENSIONAL DIFFUSION EQUATION BY THE METHOD OF FINITE ELEMENTS. Franke, H. P.; Schmidt, F. A. R. 1 Jul 1974. Translation by Ernest G. Silver of IKE-4-25. 79p. Dep. NTIS $7.00.

The program FEM-2D was developed to study the applicability of the Finite Element Method (FEM) to the solution of the two-dimensional multi-group diffusion equation, and to investigate the problems that arise in this connection. The program utilizes triangular elements with quadratic flux trial functions. The matrix equations which result from the discretization process are solved by a modified Choleski method. In this procedure unnecessary operations on zeros are largely avoided. However at present it is still necessary in the current version to hold the entire system matrix for one group in the fast storage at one time. 17 references. (auth)

19158 (RT/FI-(75)4) TIME-DEPENDENT GENERALIZED PERTURBATION METHODS FOR BURN-UP ANALYSIS. Gandini, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jan 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

A procedure is presented, as derived from the time-dependent generalized perturbation methods, for the calculation of the

sensitivities of integral quantities relevant to burn-up and build-up processes in nuclear systems with respect to the coefficients which appear in the burn-up and decay equations. In the illustrative example given, it is shown how the approximate perturbative expressions which are thereby obtained correspond to the evaluation of the first derivative of the given integral quantity with respect to such coefficients. (auth)

19159 VARIABLE WORK REGIME OF THE N_2O_4 EXPERIMENTAL INSTALLATION WITH COMBUSTION HEATERS. Gimmel'shtein, Ya.; E.; Greven'kov, Zh. A.; Denisova, V. V.; Zatsepin, O. I.; Tambovtsev, A. D. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 49-53(1975). (In Russian).

A joint work of the binary plant with turbojet in the first loop and dissociating working substance N_2O_4 in the second contour is considered. The methods of regulation of the second contour load under economical conditions are investigated as well as fuel economy and limit temperatures of the walls of heater tubes. (auth)

19160 CURRENT STUDIES ON REACTOR CORE HEAT TRANSFER. Aoki, S. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor). Nippon Genshiryoku Gakkaishi; 16: No. 9, 469-477(Sep 1974). (In Japanese).

The papers presented in meetings on reactor core heat transfer can be classified roughly into the categories of: (1) Helium heat transfer, (2) Heat transfer on extended or rough surfaces, (3) Critical heat flux correlations for water-cooled reactor, (4) Subchannel analysis in the fuel assemblies of BWR and PWR, (5) Theoretical and experimental research on eddy diffusivity in sodium flow, (6) Subchannel analyses in LMFBR fuel pin bundle. Such work is reviewed and recent trends seen in the studies associated with reactor heat transfer are described, with particular reference to the papers presented at the International Seminar on Liquid Metal Heat Transfer at Trogir, Yugoslavia, and the 1973 International Meeting on Reactor Heat Transfer. (auth)

19161 NUMERICAL SOLUTION TO CRITICAL PROBLEM OF FINITE CYLINDRICAL REACTORS BY VARIATIONAL METHOD. Horie, J.; Nishihara, H. (Kyoto Univ. (Japan). Faculty of Engineering). J. Nucl. Sci. Technol. (Tokyo); 11: No. 9, 359-368(Sep 1974).

Making use of the variational method, an expression is derived for the upper and lower bounds of the largest eigenvalue of the one-velocity transport equation, in terms of the Rayleigh quotient. It is found that the error contained in the eigenvalue thus obtained increases or decreases in keeping with the error inherent in the trial function used for expressing the neutron flux distribution. The first approximation for the eigenvalue and the extrapolation distances of finite cylindrical reactors are determined by using the asymptotic flux shape as trial function. The second and third approximations for the eigenvalue are derived by supplementing the asymptotic function with additional orthogonal terms. It is proposed to combine the eigenvalue determined by the variational method with the second approximation of the flux obtained by applying the integral transport operator to the asymptotic flux. Evidence is presented to prove the convergence of an iterative procedure devised for successively applying the transport operator. The results obtained by the above method are compared with those calculated by the flat-flux approximation, the P_1 approximation and the two-dimensional S_N code TWOTRAN. (auth)

19162 INVESTIGATION OF VIBRATION OF A CYLINDER BY PARALLEL LIQUID FLOW. Koishikawa, S.; Sakano, K.; Izaki, T. (Kawasaki Heavy Industries, Ltd., Kobe (Japan)). FAPIG (Tokyo); No. 71, 167-175(Nov 1973). (In Japanese).

The results of a bibliographical investigation are reported, concerning (1) fluid force acting on a cylinder, (2) oscillation mechanism, (3) stability of vibration, and (4) response to vibration. Several examples of accidents are listed concerning EBR-2 reactor, GETR reactor, Big Rock Point reactor, Yankee reactor, Spert-3 reactor, Fermi reactor, and Tokai reactor. Many accidents have been caused by vibrations due to fluid flow. In the case of fuel rods and heat exchanger pipes, the vibration induced by fluid flow can be classified into two cases by the relationship between structure and direction of fluid flow. One is the fluid flowing in the perpendicular direction to the structure, and the other is the fluid flowing in the parallel direction to the structure. As the result of experiments on parallel flow, it has been found that breakdown is caused by fretting corrosion and fatigue. It was found that Wambsganss' arithmetic model agreed with experimental results. (JA)

19163 RECENT ADVANCES AND OUTSTANDING TOPICS IN FAST REACTOR PHYSICS. Hirota, J.; Takano, H.; Tone, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment); Matsunobu, H.; Sugawara, A. Nippon Genshiryoku Gakkaishi; 16: No. 10, 516-533(Oct 1974). (In Japanese).

Since the 1969 BNES International Conference on the Physics of Fast Reactor Operation and Design in London, significant advances have been made in fast reactor physics. In October 1973 there was held an International Symposium on Physics of Fast Reactors, in Tokyo. Based principally on the papers presented at this Tokyo Symposium a review is presented on the progress of fast reactor physics in recent years, and the outstanding topics of importance. (auth)

19164 GENERAL METHOD FOR GENERATING EFFECTIVE RESONANCE CROSS SECTIONS FOR HETEROGENEOUS MEDIA. Kirby, K. D. Atlanta; Georgia Inst. of Tech. (1974). 134p. University Microfilms Order No. 75-12,999.

Thesis (Ph. D.).

For nuclear reactors in which there is a heterogeneous arrangement of materials with resonance structure in the neutron cross sections, the neutron flux will have strong variations in space and energy. In order to obtain effective cross sections which account for these variations, validated methods for including the spatial component of resonance self-shielding are required. Current techniques generally include the effect of spatial self-shielding by applying an equivalence theory between homogeneous and heterogeneous cases or by integral transport theory methods which retain one of the assumptions of equivalence theory, namely, that the spatial neutron flux be flat. This work develops a general method of cross section averaging which does not resort to the flat-flux assumption, but uses a generalized reciprocity relation and defines an energy-dependent escape cross section which can account for spatial nonuniformity. Integral transport theory calculations are performed which determine the effects of nonuniformity in the resolved resonance region of ^{238}U for a typical fast critical reactor and are used to characterize the nonuniformity parameters of the general method. The resulting effects of nonuniformity on average cross sections are found to be small, generally less than 1 percent. The parameters of the general method show the small effect to be due to compensations which occur in the treatment of nonuniform sources, and these compensations are discussed. The results of this work tend to point out that current differences in calculated and experimental results are not due to the spatial treatment of the slowing-down source. (Diss. Abstr. Int., B)

Reactor Components and Accessories

Refer also to abstracts 17160, 17296, 17724, 17735, 17801, and 17807.

19165 (CONF-7410123-, pp 7.1-7.16) RECENT INVESTIGATIONS ON REACTOR IN-CORE INSTRUMENTATION. Boeck, H. (Atominstitut, Vienna). 1974.

From 3rd European conference of TRIGA users; Neuherberg, F.R. Germany (29 Oct 1974).

In third European conference of TRIGA users. (General Atomic Co., San Diego, Calif. (USA)).

Work has been carried out during the last two years to test and investigate certain parts of in-core fission chambers such as mineral insulated cables and the electrode coating. Mineral insulated cables have been studied excore to obtain information on temperature induced currents in the cable. The influence of moisture, external pressure, and time on the resistance of different cable types have been investigated. The uranium coating on the fission chamber electrode is one critical part of the whole system. In cooperation with industry a new method for coating the electrode with 93 percent enriched U-235 has been developed and the performance of this layer under different neutron doses up to 2.10^{20} nvt has been investigated. Experiments have continued with self powered neutron detectors with different emitters of Co, Er, Hf and Pt. These detectors have been exposed to several power squared and to pulse irradiation. The time behavior of the SPN was compared with the signal of an excore ionization chamber. Characteristic deviations from linearity were observed at fast reactor periods of all detectors. The cause of these deviations is not yet fully understood, but temperature effects in the detector material seem to be one of the main reasons. Therefore an irradiation capsule for incore detectors and mineral insulated cables is under construction which permits heating the specimen up to 800°C while under irradiation. (auth)

19166 (JAERI-M-5868) SURVEILLANCE TEST OF LIGHT-WATER POWER REACTORS, 1. Practice and Items of the Tests. Kodaira, T.; Ishimoto, K. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 35p. (In Japanese). INIS. NTIS (US Sales Only) $4.75.

Surveillance tests of LWR pressure vessels are carried out to ensure their structural integrity. Practices and specifications of the tests in standards ASTM E185-66 and -73 and JEAC 4201-1970, which are issued by the American Society for Testing and Materials and the Japan Electric Association, respectively, are compared. (auth)

19167 (ORNL-Sub-3131-10(Ph.)) PRELIMINARY EVALUATION OF CLOSELY SPACED REINFORCED OPENINGS IN A CYLINDRICAL PRESSURE VESSEL UNDER INTERNAL PRESSURE LOADING. Mershon, J. L.; Rodabaugh, E. C. (Battelle Columbus Labs., Ohio (USA)). 30 Jun 1975. 77p. Dep. NTIS $7.00.

For Oak Ridge National Lab., TN.

A preliminary evaluation of the problem of two closely spaced reinforced nozzles in cylinders in terms of the data which are now available and in terms of the additional data which appear necessary in order to provide assured design rules, stress indices, etc., as would be required for Section III (Class I vessels) of the ASME Code for nuclear reactor pressure vessels is presented. (TSS)

19168 (RT/ING-(74)29) SS-TVF A COMPUTER CODE FOR TURBULENT FLOW VELOCITY FIELD CALCULATIONS IN SQUARE ARRAY ROD SUBCHANNELS. Marinelli, V.; Pastori, L. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

SS-TVF computer code calculates the velocity distribution of a turbulent flow in square array rod subchannels. The method used, experimentally tested by the authors in a 16-rod tests section, is based on the evaluation of the local wall shear stresses, including secondary flow effects, as suggested by Ibragimov, Subbotin and on the application of Reichardt's velocity universal laws for round tubes along the normal to the walls. The code can be applied to any fluid, i.e. water, air, liquid metals, etc. and constitutes the first step for the evaluation of the temperature field in channels of complex geometries used in nuclear reactors, steam generators and heat exchangers. Calculated friction factor and maximum/average velocity ratios plots for square array subchannels of different pitch/rod diameter ratios are supplied, for water at 25°C. SS-TVF is written in FORTRAN IV language for 360 IBM systems. (auth)

19169 (RT/ING-(75)28) TS-TVF A COMPUTER CODE FOR TURBULENT FLOW VELOCITY FIELD CALCULATION IN TRIANGULAR ARRAY ROD SUBCHANELS. Marinelli, V.; Pastori, L. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

TS-TVF computer code calculates the velocity distribution of a turbulent flow in triangular array rod subchannels. The method used, experimentally tested by the authors in a 16-rods test section, is based on the evaluation of the local wall shear stresses, including secondary flow effects, as suggested by Ibragimov, Subbotin and on the application of Reichardt's velocity universal laws for round tubes along the normal to the walls. The code can be applied to any fluid, i.e. water, air, liquid metals, etc. and constitutes the first step for the evaluation of the temperature field in channels of complex geometries used in nuclear reactors, steam generators and heat exchangers. Calculated friction factor and maximum/average velocity ratios plots for triangular array subchannels of different pitch/rod diameter ratios are supplied, for water at 25°C. TS-TVF is written in FORTRAN IV language for 360 IBM systems. (auth)

19170 SOLID RADWASTE SYSTEM EXPERIENCE IN EUROPE. Herter, R.; Stewart, J. E. (Werner and Pfleiderer Corp., Waldwick, NJ). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 12-13 (1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19171 STEAM TURBINES. Raab, A. (Kraftwerk Union A. G., Muelheim an der Ruhr (F. R. Germany)). Brennst.-Waerme-Kraft; 27: No. 4, 170-172(Apr 1975). (In German).

The state of development of the year 1974 is outlined. It is characterized by an adaptation of steam turbine technology to the consequences of the economic changes in energy technology. The survey is supplemented with 52 references. (GE)

19172 HANDLING TOOL, IN PARTICULAR FOR CONTROL ELEMENTS IN A NUCLEAR REACTOR. Dose, G.; Hoffmeister, B. (to Krupp (Friedr.) G.m.b.H., Essen (F. R. Germany)). German Patent Document 2344266/S/. 6 Mar 1975. 31p. (In German).

A handling tool for easy and reliable replacement of long, thin fuel and control rods in nuclear reactors is claimed. (GE)

19173 MEASUREMENT OF ANGULAR DEPENDENT SCATTERING SPECTRA ON CRYSTALLINE MODERATORS. Aizawa, O.; Fukano, Y. (Tokyo Inst. of Tech. (Japan)); Kanda, K. Bull. Tokyo Inst. Technol. (Engl. Ed.); No. 121, 11-18(Mar 1974).

The angular dependent scattering spectra of crystalline moderators such as beryllium, beryllium oxide and carbon were measured by using thermal neutrons from the heavy water thermal neutron facility of KUR, Kyoto University Research Reactor, operated at a power of 5 MW. The pure Maxwellian neutrons from the thermal column were injected into a chopper after collimation. The chopped neutrons were again collimated, and led to a flight tube. They were scattered by a sample located at an end of the flight tube of about 6 meters. ^{3}He counters of 1 inch diameter, shielded with 1 cm thick B_4C cylinders, were utilized as neutron detectors. The angular position of the detectors was set so as to make angles of 30, 45, 60, 75, 90, 115, 120, 135 and 150 degrees to the incident beam. Scattered neutron intensity I (E_0, θ) was measured as a function of scattering angle θ. Specimens were beryllium (0.5 × 10 × 10 cm), beryllium oxide (0.5 × 10 × 10 cm), carbon (0.6 × 10 × 10 cm) and glassy carbon (0.6 × 10 × 10 cm). The peak width of scattering spectra is decided by two resolution factors. The first is the burst width of the chopper, which decreases as wave length increases. The other is the resolution concerning with the solid angle of scattered neutrons over the counter. The resolution decreases as scattering angle decreases. (JA)

19174 RECENT TRENDS OF NUCLEAR STEAM TURBINE-GENERATOR. Hisano, K.; Yasumoto, A.; Oka, Y. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works). Hitachi Hyoron; 56: No. 9, 889-894(Sep 1974). (In Japanese).

Planned unit capacities of nuclear power plants in Japan are increasing 800 to 1,100 MW(e), approaching the US level. Features and characteristics of steam turbine-generators for these growing nuclear power plants are discussed along with operating experience with recently manufactured units of Hitachi. (auth)

19175 ELECTRICAL CABLE PENETRATION ASSEMBLY FOR PRIMARY CONTAINMENT VESSEL OF NUCLEAR REACTOR. Igarashi, T.; Kato, Y. (Hitachi Cable, Ltd., Tokyo (Japan)); Takumi, K. Hitachi Hyoron; 56: No. 8, 725-729(Aug 1974). (In Japanese).

The electrical cable penetration assembly for primary containment vessels for nuclear reactors needs to be capable of preventing leakage of radioactive substances under normal operating conditions as well as emergency conditions. Three different types of electrical cable penetration assemblies were fabricated, including: medium voltage cable penetration assembly for large (5000 V) power cables, low voltage cable penetration assembly for 600 V power control and instrumentation cables, and shielded signal cable penetration assembly for shielded and unshielded signal cables. In a series of tests which were carried out under normal operating conditions (66°C) and emergency conditions (171°C, 4.5 kg/cm^{2}G, 6 hours; 138°C, 4.5 kg/cm^{2}G, 10 days) the assemblies performed well. (auth)

19176 OFF-GAS RECIRCULATION SYSTEM FOR NUCLEAR REACTORS. Eppler, M.; Lade, H. J. (to Kraftwerk Union A. G., Muelheim an der Ruhr (F. R. Germany)). German Patent Document 2338044/A/. 20 Feb 1975. 5p. (In German).

An off-gas system designed to keep the amount of off-gas discharged into the outside air as small as possible is described. The connecting line with the outside air is provided with a buffer tank to take up the off-gas which penetrates into the ring main only temporarily, depending on the reactor operation. (GE)

Reactor Fuels

Refer also to abstracts 16923, 16924, 16930, 16934, 16940, 16942, 16950, 16953–16955, 17682, 17694, and 17735.

19177 (ANL-8150) THERMAL-PULSE METHOD FOR MEASURING GAP CONDUCTANCES IN GAS-BONDED FUEL ELEMENTS. Renken, C. J.; Cox, C. W.; Sather, A. (Argonne National Lab., Ill. (USA)). Mar 1975. Contract W-31-109-Eng-38. 37p. AT.

A method with the capability of nondestructively measuring the approximate value of bond conductance of tubular, gas-bonded fuel elements in a hot cell was developed. The technique uses the heat decay of a laser-induced hot spot to assess the gap conductance in a fuel element and to deduce the gap size. The developed theoretical heat-flow equations yield results that agree well with the experimental data. An experimental system was built, calibrated, and demonstrated. 7 references. (auth)

19178 (BNWL-1896) COVE-1: A FINITE DIFFERENCE CREEP COLLAPSE CODE FOR OVAL FUEL PIN CLADDING

MATERIAL. Mohr, C. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-1830. vp. Dep. NTIS $5.45.

COVE-1 is a time-dependent incremental creep collapse code that estimates the change in ovality of a fuel pin cladding tube. It uses a finite difference method of solving the differential equations which describe the deflection of the tube walls as a function of time. The physical problem is nonlinear, both with respect to geometry and material properties, which requires the use of an incremental, analytical, path-dependent solution. The application of this code is intended primarily for tubes manufactured from Zircaloy. Therefore, provision has been made to include some of the effects of anisotropy in the flow equations for inelastic incremental deformations. 10 references. (auth)

19179 (TID-26818) GAP CONDUCTANCE THERMAL OSCILLATOR FEASIBILITY TEST (1-1) QUICK LOOK REPORT. Crocker, J. G. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). 14 Feb 1975. 21p. Dep. NTIS $4.25.

A test performed in the Power Burst Facility to obtain data on test fuel rod cladding surface temperature oscillations and phase angles during sustained power oscillations is described. Thermal oscillator test (1-1) was conducted under PBF Experiment Operating Procedure-021, Gap Conductance Thermal Oscillator Feasibility Test. Detailed descriptions of the thermal oscillator test (1-1) conditions, procedures, and preliminary results obtained are provided. The preliminary results indicate good agreement with calculated values for cladding surface temperature oscillations and phase angles, and provide encouraging evidence of the potential application of the thermal oscillator technique for obtaining gap conductance information. 6 references. (auth)

19180 FUEL GRID FOR FAST NEUTRON REACTOR. Nakai, Y. (to Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)). Japanese Patent 1973-7021/B/. 24 Apr 1968. 3p. (In Japanese).

In a fuel grid for a fast reactor wherein fuel rods are clustered at predetermined intervals within a horn pipe, the respectively adjacent fuel rods are coupled to one another by the engagement between a wing piece having two axially-extending sheets and a wing piece having one sheet adapted to be inserted between the two axially-extending sheets. The wing pieces are disposed on the outer circumferential surface of each fuel rod cladding pipe, and the fuel rods located at the peripheral part of the fuel rod cluster are coupled to the horn pipe by the engagement between a wing piece having two axially-extending sheets similar to the above-mentioned ones and being disposed on the inner wall surface thereof and the wing piece of the fuel rod having one sheet. The fuel rod may freely expand in the axial direction while it is prevented from rotating about its axis and from moving laterally in a direction perpendicular to its axis, so that the fuel rod is not distorted due to a temperature elevation and is checked from vibrating. The wing pieces are constructed of thin-walled plates, so that the flow resistance against a coolant is very low. (JA)

Reactor Control Systems

19181 (AI-AEC-Memo-12716) ZrH REACTOR DESIGN STUDIES. Donovan, E. J.; Maki, L. M. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Jun 1969. Contract AT(11-1)-GEN-8. 285p. Dep. NTIS $17.25.

Declassified 5 Jun 1973.

The results of a number of detailed design and performance studies conducted in the process of establishing the conceptual design of the Reference Zirconium Hydride Reactor are presented. (auth)

19182 (NAA-SR-Memo-11393) REACTOR-SHIELD WEIGHT STUDIES OF INTRINSICALLY SUBCRITICAL LOW POWER SYSTEMS. Norman, R. H.; Oliver, D. G. (Atomics International Div., Canoga Park, Calif. (USA)). Apr 1966. 57p. Dep. NTIS $6.00.

Declassified 1 Jul 1974.

The effect of intrinsic subcriticality on system weight and other design parameters was studied in a low power, shadow shielded system, as characterized by SNAP 10A. Reactor-shield system weights were calculated for cores of different reactivity in a water environment. Parameters held constant were (1) shielding requirements, (2) reactor reactivity, and (3) core composition. Changes in core geometry, including BeO axial reflectors, and the use of gadolinium poisoning in the fuel cladding were studied. The importance of reactor geometry in achieving intrinsic subcriticality with minimum system weight is established. Intrinsic subcriticality is achieved without significantly affecting system weight. (auth)

19183 (NAA-SR-Memo-11688) DESIGN STUDY OF A 4π SHIELDED MANRATED REACTOR. Simms, R.; Tobler, R.; Crane, J. (Atomics International Div., Canoga Park, Calif. (USA)). 13 Oct 1965. 42p. Dep. NTIS $5.25.

Declassified 4 Jul 1974.

A conceptual study to design a SNAP 8 reactor with rendezvous shield for manned applications has been completed. Poison-backed and void control drums were compared The potential weight savings with the use of poison-backed drums amounted to over 1000 pounds. The reactor and shield design which gave the minimum weight (14,100 pounds) employed poison-backed control drums and advanced shielding materials. The minimum weight system using conventional shielding materials was 20,000 pounds. (9 references) (auth)

19184 (RN-S-0011) PRELIMINARY CONTROL AND ANALYSIS OF THE DYNAMICS OF MALFUNCTIONS OF THE AJ30-5 NERVA ENGINE. (Aerojet-General Corp., Azusa, Calif. (USA)). 19 Oct 1963. 116p. Dep. NTIS $9.00.

Declassified 7 Sep 1973.

Stability of the controls system was evaluated on the basis of Bode plots and closed-loop response to step inputs. Two modes of engine control were considered: a pressure demand signal as a function of measured temperature and a temperature demand signal as a function of measured pressure. Component and system errors were evaluated on the basis of their effects on transients operation. The effects studied were primarily limited to the magnitude of perturbations induced in the transients. Many other considerations should be investigated. Only a few component failures have been analyzed for transient effects. Within the limitations of the malfunctions studied, some alternate control modes have been investigated, primarily determination of the stability of such a control mode. Inherent system compensation has also been evaluated for certain malfunctions. The preliminary analysis indicated that a compatible malfunction mechanism can be developed, and that the mechanization should center around the temperature transducer because it has been shown that the engine can be controlled simply on the temperature transducer signal. Furthermore, the integrity of many engine components depends on thermal control. This type of mechanization, if developed, could virtually replace a loss of all other control signals. (auth)

19185 (TI-652-220-006) DESIGN SUMMARY: REFLECTOR DRIVE SYSTEM. Thexton, R. T.; Nakae, T. S. (Atomics International Div., Canoga Park, Calif. (USA)). 10 Oct 1972. 49p. Dep. NTIS $5.50.

The design requirements, design description and expected performance of the reflector and drive control system are summarized. (auth)

19186 (TI-652-220-007) 5 KWE REACTOR TE REFLECTOR SECTOR DRIVE ACTUATOR DESIGN SUMMARY. Donelan, L. E. (Atomics International Div., Canoga Park, Calif. (USA)). 4 Oct 1972. 24p. Dep. NTIS $4.25.

The results of the 5 kW(e) Reactor TE System actuator parametric study and subsequent load and performance calculations are presented together with the results of the stress analysis. 12 references. (auth)

19187 (TI-696-22-003) CONTROL DRUM DRIVE TRAIN AND ACTUATOR DESIGN. Bilibin, K.; Harwood, D. (Atomics International Div., Canoga Park, Calif. (USA)). 10 Apr 1970. 138p. Dep. NTIS $10.00.

The design analysis of the control drum drive train including the mockup actuator assemblies are documented. 5 references. (auth)

19188 (TI-696-220-012) DEVELOPMENT OF AN IMPROVED ACTUATOR FOR ZrH REACTOR SYSTEMS: A HISTORICAL REFERENCE. Donelan, L. E. (Atomics International Div., Canoga Park, Calif. (USA)). 7 Jul 1971. 30p. Dep. NTIS $4.50.

The history of the actuator for the ZrH Reactor system is presented. The present design status is summarized. (auth)

19189 (TI-700-14-002) IWS ANALYSIS. Rhoades, W. A.; Dray, B. J. (Atomics International Div., Canoga Park, Calif. (USA)). 2 Jan 1970. 46p. Dep. NTIS $5.50.

The effect of Gadolinium-155 on the prompt kinetic behavior of a zirconium hydride reactor has been deduced, using experimental data from the SNAPTRAN machine. The poison material makes the temperature coefficient more positive, and the Type IV sleeves were deduced to give a positive coefficient above 1100°F. A thorough discussion of the data and analysis is included. (auth)

19190 (TI-759-130-001) CONTROL OF ZrH REACTOR REACTIVITY PERTURBATIONS DURING ORBITAL MANEUVERS. Audette, R. F. (Atomics International Div., Canoga Park, Calif. (USA)). 9 Sep 1970. 18p. Dep. NTIS $4.00.

Scheduled and inadvertent vehicle maneuvers in manned and unmanned space missions may result in reactivity perturbations to the ZrH reactor due to fuel and control drum motion from acceleration forces. Potential power and outlet coolant temperature excursions could result in interruptions of PCS power generation, or excessive coolant temperatures if uncontrolled. This analysis compares potential uncontrolled reactor transients with allowable transients for uninterrupted electrical power generation from a Brayton system, and presents a control scheme to limit transient reactor outlet temperatures to 1250°F for a system designed to operate at a nominal 1200°F reactor outlet. Potential uncontrolled transients could result in a reactor outlet temperature swing of +-77°F about a nominal 1200°F and a reactor power swing of +92 Kwt and -67 Kwt about a nominal 130 Kwt for the Brayton System. (auth)

19191 (TI-759-220-002) THERMAL ANALYSIS OF THE ZrH REACTOR 4 Pi AND VOID BACKED REFLECTOR ASSEMBLIES. Larson, E. M. (Atomics International Div., Canoga Park, Calif. (USA)). 21 Jun 1971. 66p. Dep. NTIS $6.50.

A steady state thermal analysis is presented for: a BeO-TaIOW-B_4C poison back drum, and a Be void back drum. TAP listings and a results summary are presented for both drums. The results indicate the poison back drum may be used with an 1150°F cold wall and the void back drum may be used with a 1000°F cold wall. (14 references) (auth)

19192 (TI-759-240-012) DETERMINATION OF EXCESS REACTIVITY AND CONTROL WORTH FOR THE CORE TEST REACTOR. Rood, H.; Roberts, R. (Atomics International Div., Canoga Park, Calif. (USA)). 12 Oct 1970. 51p. Dep. NTIS $5.75.

One-dimensional scoping calculations were performed to determine the reactivity and control worth characteristics of several core and reflector configurations for the Core Test Reactor. A comparison was made of three reflector designs: (1) six S8DR drums, 4.5 inches in radius; (2) seven S8DR drums, 4.5 inches in radius; and (3) six new drums, 6.25 inches in radius. Only the third option, six new drums, appears to have sufficient control and reactivity to provide adequate margins to achieve the design lifetime. Parametric studies of the nuclear effects of the internal reflector composition indicated that the Be/BeO area should be maximized in order to increase reactivity, and that the steel/nickel area should be minimized in order to increase reactivity and control. 8 references. (auth)

19193 (ZJE-161) NEUTRON DENSITY OPTIMAL CONTROL OF A-1 REACTOR ANALOGUE MODEL. Grof, V. (Skoda, Plzen (Czechoslovakia)). 1975. 37p. Dep. NTIS (US Sales Only) $5.00.

Two applications of optimal control of the A-1 reactor analog model. Both cases deal with the control of reactor neutron density. Two versions of optimal control algorithms are derived using modern control theory (Pontrjagin's maximum principle, the calculus of variations, and Kalman's estimation theory), the minimum time performance index, and the quadratic performance index. The results of the analysis of optimal control are compared with conventional control of the A-1 reactor. (auth)

19194 CONTROL PANEL DESIGN: AN ADDITIONAL IMPACT ON PLANT OPERATION. Kaiz, G. H. (NUS Corp., Rockville, MD). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 16-17 (1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19195 POSSIBILITY OF CONTROLLING THE CAPACITY OF A POWER SYSTEM WITH NUCLEAR POWER STATIONS. Berkovich, V. M.; Gorokhov, V. F.; Tatarnikov, V. P. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 6, 22-26(Jun 1974).

Translated from Teploenergetika; 21: No. 6, 16-19(Jun 1974).

The operation of nuclear power plants under peak-load conditions to meet power system needs is discussed. The problem of controlling a WWER type reactor to meet peak load conditions is described as an example. (JWR)

19196 MEASURING SYSTEM. Aleite, W.; Klar, E.; Spillekothen, H. G. (to Siemens A. G., Muenchen (F. R. Germany); Siemens A. G., Berlin (F. R. Germany)). German Patent Document 2222432/B/. 27 Feb 1975. 4p. (In German).

A measuring system for neutron flux density in the reactor core is claimed. It consists of stationary in-core probes and other, mobile probes that are temporarily inserted into the core. Insertion of the mobile probes is started by the stationary detectors at fixed measured values. (GE)

19197 NUCLEAR POWER PLANT DESIGN. Torres, J. M.; Musick, C. R. (to Combustion Engineering, Inc., Windsor, Conn. (USA)). German Patent Document 2434528/A/. 20 Feb 1975. 27p. (In German).

A control system for nuclear power plants is described. Even after turbine failure and/or turbine shutdown, unnecessary fast shutdowns are prevented. (GE)

Nuclear Power Plant Economics

19198 TECHNICAL-ECONOMIC ANALYSIS OF ONE-CIRCUIT NUCLEAR POWER PLANTS. Popyrin, L. S.; Starostenko, N. N.; Malebskii, A. L. (Siberian Energy Inst., Novosibirsk, USSR). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 9-12(1975). (In Russian).

Technical and economical analysis results of the heat-power part of the single-circuit Atomic Power Station are presented. (auth)

19199 ENERGY CONVERSION. IV. Improvements in Energy Conversion Technology. Buende, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Brennst.-Waerme-Kraft; 27: No. 3, 106-111(Mar 1975). (In German).

A series of lectures held at the 9th World Energy Conference 1974 in Detroit is summarized. Problems of utilization of nuclear energy are discussed. The problems are connected with present and future types of reactors: light-water reactors, heavy-water reactors, the high-temperature reactor, the fast breeder and the fusion reactor; and with the possible future requirements for medium-load operation of nuclear power stations. Other lectures discussed: (a) problems of fossil fuel utilization (possible reduction of the NO_x content of waste gas and the development of MHD generators; (b) thermodynamic circuits with unconventional operating media; (c) a model for the calculation of the load-optimal layout of newly constructed power plants; (d) the possibility of peak supply in a country where hydroelectric power plants prevail (Brazil); and (e) energy research in Australia. (GE)

19200 POWER PLANT DESIGN AND SITING IN EUROPE AND THE UNITED STATES. Arch. Energiewirtsch.; 29: No. 3, 221-229(Mar 1975). (In German).

Also published in Electr. Rev., v. 195(17) p. 595-597.

Some reports and subjects of discussion of the AIM meeting in Luettich in October 1974 are summarized. The problems connected with the construction programs for nuclear power plants drawn up by the EVU are discussed and technical progress in the field of nuclear steam generators is reported. It is stated that industrial utilization of the sodium-cooled fast reactor seems possible even now, and that further development of the helium-cooled high-temperature reactor into a fast breeder is unnecessary. Other issues are turbogenerators, conventional steam generators, pump-fed power stations, and compressed-air storage. It is concluded that the multinational groups are highly responsible for future developments. (GE)

19201 FRAGEN UND ANTWORTEN ZUR KERNENERGIE. (Questions and Answers Concerning Nuclear Power). Grupe, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Stabsstelle Oeffentlichkeitsarbeit); Koelzer, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Strahlenschutz und Sicherheit). Bonn, F. R. Germany; Informationszentrale der Elektrizitaetswirtschaft (Jan 1975). 96p. (In German).

The pamphlet discusses problems of nuclear energy which are of public interest. Aside from remarks on the necessity of nuclear power stations for securing the present and future energy supply, questions of rentability of existing and planned reactor types are answered. Licensing procedures are discussed for nuclear power stations. Comments on problems of reactor safety and environmental impact of radioactive effluents and waste heat are presented. Some definitions of technical terms are given. (GE)

19202 PROMETHEUS WIRD NICHT STERBEN. Energie fuer Heute und Morgen. (Prometheus Will Not Die. Energy for Today and Tomorrow). Gerwin, R. Duesseldorf, F. R. Germany; Econ (1974). 308p. (In German).

The difficult scientific and technical connections in the problematic field of energy sources, energy production, and energy consumption are discussed. The political and social proceedings which are involved with these topics are outlined. (GE)

19203 IMMISSION POOR HEAT SUPPLY. Stumpf, H. VDI (Ver. Dtsch. Ing.) Ber.; No. 222, 23-32(1974). (In German).

From the viewpoint of promotion of immission-poor power supply, state assistance for power industry is needed and an accelerated reactor licensing procedure for the first city-sited nuclear power plant of the German Federal Republic is necessary. (GE)

19204 PROGRESS OF NUCLEAR INDUSTRY DURING FIFTEEN YEARS. Analysis of Results of Investigation into Nuclear Industry. Genshiryoku Chosa Jiho; No. 21, 17-58(May 1973). (In Japanese).

An investigation has been carried out annually to obtain information useful for the establishment of development policy for Japanese nuclear industry. The investigation was started in 1956. The industry was in a developing and preparation stage during the first 10 years. Then it entered a practical stage, and its expenditures, sales, and personnel have significantly increased due to the successful start of nuclear power plant construction. Detailed analyses are given for the above expenditures, sales and personnel from different angles, and a prediction is made of the number of future personnel. However, the industry is still being operated with "red ink" finances, as the sales exceeded expenditures only twice (1963 and 1969). (JA)

19205 PROSPECT FOR DEVELOPMENT OF ALTERNATIVE ENERGY RESOURCES. Oshima, K. (Tokyo Univ. (Japan)). At. Jap.; 18: No. 4, Suppl., 55-68(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

The energy supply picture for the future is considered in two stages, short-range and long-range problems. In the next ten years or so, means such as the use of coal for stabilizing the price of petroleum, is the primary consideration. Then, in the second stage, beyond about 1985, the development of alternative energy resources, both in quantity and quality, becomes necessary. In this respect, nuclear power, especially by breeder reactors, plays a central role. (JA)

19206 LONG TERM PROGRAM OF ATOMIC ENERGY DEVELOPMENT. Inaba, H. (Atomic Energy Commission, Tokyo (Japan)). At. Jap.; 18: No. 4, Suppl., 69-77(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

The situation of Japanese energy supplies along with the economic growth rate in the past several years is reviewed. For the period of 1980 to 1985, the picture of energy supplies is estimated under three alternatives. In this relation, the role to be played by nuclear power is set forth. The importance of public trust in the safety of nuclear power generation is emphasized. (JA)

19207 AN OUTLINE OF THE FRENCH NUCLEAR DEVELOPMENT PROGRAM. Pierre, C. (CEA, 75 – Paris (France). Dept. des Programmes). At. Jap.; 18: No. 4, Suppl., 86-94(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

France is affected greatly by the current energy crisis; in this picture, the role of nuclear energy is significant. The large project of LWR power generation by EdF is now proceeding. The main short-term research and development in CEA is directed to bring this project into a success. Nuclear safety is also the main theme of France, and studies are made for the various types of reactor plants. Fast reactor development is the main research effort by CEA. Its history down to the current phase is described at length, from Rapsodie through Phenix. Finally, there is a high-temperature reactor program; which is carried out with cooperation of the United States. (JA)

19208 DEVELOPMENT OF ADVANCED REACTORS IN THE U. S. A. Kintner, E. E. (USAEC, Washington, D. C.). At. Jap.; 18: No. 4, Suppl., 95-106(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

The course of reactor development in the United States has been largely dominated by the development of light water reactors. Any new type of reactor must be economically competitive with the established LWR system, as well as efficiently utilize uranium resources. In the United States, the Liquid Metal Fast Breeder Reactor program is proceeding. It is achieved broadly through four stages: EBR-II leading to the development of the Fast Flux Test Facility (FFTF); a Demonstration Reactor; and finally by a commercial reactor. The aspect of public acceptance emerges as an important aspect for any new concept. (JA)

Reactor Licensing and Regulation

19209 (BQ-TOP-1(Rev.1A)) BECHTEL QUALITY ASSURANCE PROGRAM FOR NUCLEAR POWER PLANTS. Bernsen, S. A. (Bechtel Power Corp., San Francisco, Calif. (USA)). 1 May 1975. 96p. Bechtel Power Corp., San Francisco, CA.

This document describes the Bechtel Quality Assurance Program plan for use by the Bechtel Thermal Power Organization during the design, procurement and construction of nuclear power plants. This Program plan meets the requirements of the Atomic Energy Commission Regulation 10 CFR 50 Appendix B. (auth)

19210 (CONF-740807-P2, pp 647-656) STATE OF NUCLEAR POWER REGULATION. Myntzing, L. M. (Atomic Energy Commission, Washington, DC). Mar 1975.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

In proceedings of the thirteenth AEC air cleaning conference. (USAEC, Washington, D. C.; Harvard Univ., Boston, Mass. (USA). Harvard Air Cleaning Lab.; California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

To appraise the state of the Regulatory program the status of all of the key entities are considered. Questions examined include the following: What are the intentions and matching capabilities of the regulated industry. What have interested organizations, including critics, achieved to define and illuminate the issues through searching inquiry and constructive criticism. And finally, what is the ability of the nuclear regulatory program to handle effectively the issues before it. (auth)

19211 (FIND-STN-50516) FIND: JAMESPORT NUCLEAR POWER STATION, UNITS 1 AND 2. Williams, W. H. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jul 1975. 31p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DCC)

19212 (NRCI-75/4R) NUCLEAR REGULATORY COMMISSION ISSUANCES, APRIL 1975. (Nuclear Regulatory Commission, Washington, D. C. (USA)). Jul 1975. 210p. TIC $4.00.

Issuances received from the U. S. Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DCC)

19213 (RAI-74-INDEX-2) INDEXES TO REGULATORY ADJUDICATION ISSUANCES AND ISSUANCES OF THE BOARD OF CONTRACT APPEALS, JULY–DECEMBER 1974 (AND JANUARY 1–18, 1975). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). May 1975. 93p. Dep. NTIS $5.45.

Issuances received from the U. S. Nuclear Regulatory Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DCC)

19214 DEVELOPMENT AND IMPLEMENTATION OF A QUALITY ASSURANCE SYSTEM FOR AN OPERATIONAL NUCLEAR GENERATING PLANT. Lingafelter, J. (Nuclear Services Corp., Campbell, CA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 2(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19215 IMPLEMENTATION OF THE OPERATIONAL QUALITY ASSURANCE PROGRAM. Vierzba, E. A.; Philips, M. H. Jr. (NUS Corp., Rockville, MD). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 2-3(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19216 QUALITY ASSURANCE PROGRAM FOR OPERATIONS: THE NRC REACTOR LICENSING PERSPECTIVE. Gilray, J. W. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 3-4(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19217 NUCLEAR POWER PLANT SIMULATORS FOR USE IN OPERATOR TRAINING. Raymond, W. A. (Pacific Gas and Electric Co., Eureka, CA). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 16(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19218 WRITTEN PROCEDURES: BLUEPRINTS FOR SAFE OPERATION. Ahern, P. F. (NUS Corp., Rockville, MD). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 23-24(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

19219 PROCEDURES: THE NECESSARY INSTRUMENTS FOR MANAGEMENT CONTROL. Thornburg, H. D. (Nuclear Regulatory Commission, Washington, DC). Trans. Am. Nucl. Soc., Suppl.; 21: No. Suppl. 1, 26-27(1975).

From conference on reactor operating experience; Albuquerque, NM (3 Aug 1975).

GENERAL AND MISCELLANEOUS

Information Handling

19220 (COO-3058-64) INTERACTIVE GRAPHICS ANALYSIS SYSTEM FOR NUCLEAR ENGINEERING APPLICATIONS. Danchak, M.; Moyer, W. R.; Becker, M. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Div. of Nuclear Engineering). 1973. Contract AT(11-1)-3058. 33p. Dep. NTIS $4.75.

From working with continuous slowing down theory, the need was recognized for a system which allowed rapid calculation of the theoretical flux, instant comparison with experiment and a simple means of iterating on the slowing down parameters to force flux agreement and reflect cross section modification. Similar requirements exist in other areas of nuclear work for streamlining and simplifying the data analysis process. As a solution, a unique interactive graphics analysis system (RIGAS) was devised to allow a user to calculate, display, compare, manipulate and modify his data without requiring any programming on his part. This was accomplished by establishing human primacy, through extensive human factor considerations, and designing a man-machine dialogue which responds to the mere push of a button. This system results in an instrument which maximizes man's decision making capability and the computer's speed to improve graphic communication and data analysis. (14 figs) (auth)

19221 (JINR-D10, 11-8450) INTERNATIONAL SCHOOL ON USE OF COMPUTERS IN NUCLEAR RESEARCH, TASHKENT, SEPTEMBER 18-30, 1974. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. 465p. In Russian and English). (CONF-7409122).

From international school on use of computers in nuclear research; Tashkent, USSR (18 Sep 1974).

The proceedings include lectures on the following aspects: the status and trends of development of computing technique and computer soft-ware, displays and their application in nuclear research, automation of scientific investigations using standard electronics and small computers, data handling systems and methods of modular program organization. (auth)

19222 (SGAE-2266) SDI: PROGRAM FOR SMALL COMPUTERS. Nevyjel, A. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Abt. Mathematik). Apr 1974. 58p. (In German). Dep. NTIS (US Sales Only) $6.00.

Feasibilities of information dissemination by computer are explained with respect to problems which occur by using small computers. Two program systems developed for evaluation of INIS bibliographic data on magnetic tape are described, one with possibilities for expanded profiles, the other with higher working speed by using a machine-readable thesaurus. The programs can be implemented easily at other computer installations, and are usable also for other documentation systems. (auth)

19223 (UCCND-CSD-INF-37) BRIEF STUDY OF THE RADIATION SHIELDING INFORMATION CENTER. Summers, R. M. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Computer Sciences Div.). May 1975. Contract W-7405-eng-26. 69p. Dep. NTIS $5.45.

A study of the scope, objectives, and system operations of the Radiation Shielding Information Center in Oak Ridge, Tennessee is presented. The results of a survey of RSIC users are included. (GHT)

Law

19224 (UCRL-51828) JUDICIALLY ENFORCEABLE RIGHTS UNDER NEPA. Wharton, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 May 1975. Contract W-7405-eng-48. 44p. Dep. NTIS $4.00.

The National Environmental Policy Act (NEPA) has been interpreted by the courts in many cases since its enactment in 1970. The majority of the cases which address the issue of substantive rights favor substantive review. But, the standard of review which is used varies depending on the court and the particular factual situation. Standards of review which have been used by the courts include a balancing analysis, the arbitrary and capricious test, a substantial inquiry, and a good faith compliance with NEPA. The statutory sources of substantive review are sections 101, 102 (1), 102(2)B of NEPA. In some cases by applying very strict procedural requirements, courts appear to achieve the substantive goals of NEPA of effecting changes in the federal agency decision-making process. The decisions show that the courts are proceeding on a case-by-case basis balancing environmental and traditional economic factors in order to achieve the substantive policies of NEPA. (auth)

19225 LEGAL ASPECTS OF RADIATION PROTECTION IN ITALY. Nocera, F.; Polvani, C. (CNEN, Rome). Radiol. Prot. Bull.; No. 9, vp(Oct 1974).

A general outline is presented of the Italian legislation on health protection of workers and the public in the various uses of ionising radiations, ranging from the construction and operation of nuclear reactors to the many applications of radioisotopes and radiation-emitting apparatus for industrial, commercial, scientific, and medical purposes. The articles deals in particular with the legal provisions set up in the matter, the principal competent administrations and bodies, the State's responsibility for the safe carrying out of the activities under consideration, the nuclear emergencies, and the penalties for the disregard of the above said provisions. (auth)

19226 X-RAY WARNING SIGN. Repacholi, M. H.; Gosh, S. K.; Lecuyer, D. W.; Zuk, W. M. (Dept. of National Health and Welfare, Ottawa). Health Phys.; 28: No. 6, 814-815(Jun 1975).

X rays continue to be the major contributor to the population dose and yet there is no internationally acceptable warning sign for x rays. Such warning signs are proposed that not only indicate the type of hazard, but by their shape inform the observer as to the degree of hazard. (UK)

Management

Refer also to abstracts 16695, 17174, and 17464.

19227 (CERN-75-5) STUDY OF ECONOMIC UTILITY RESULTING FROM CERN CONTRACTS. Schmied, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 6 Jun 1975. 34p. Dep. NTIS (US Sales Only) $4.75.

The technical and economic benefit to the manufacturing industries involved in CERN contracts, in relation to the expenditures on CERN by its Member States are examined. Interviews were carried out in some 130 European firms, who supplied data on estimates of increased sales and decreased costs due to CERN contracts. This "economic utility" totals 1,665 million Swiss francs (up to the year 1978), compared with a sales value to CERN of 394 MSF. Utility/sales ratios range from 0.9 to 7.3 for application fields of cables, magnets, cooling systems, vacuum equipment, electronics, and steels; they are as high as 17.3 for computers and 31.6 for precision mechanics. Some 80% of the total reported utility results from sales to markets outside high-energy and nuclear physics, for example, railways, ship-building, refrigeration, power generation, and power distribution. For the 877 MSF spent by CERN in European industry from its over-all budget of 3,500 MSF during 1955 to 1973, the total utility is estimated to be nearly 5,000 MSF. The method and procedure of analysis and quantification are discussed in detail and some specific cases are presented as examples. (auth)

19228 (CERN-75-7) HISTORY OF THE COLLABORATION BETWEEN THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN) AND THE JOINT INSTITUTE FOR NUCLEAR RESEARCH (JINR), AND WITH SOVIET RESEARCH INSTITUTES IN THE USSR, 1955-1970. Lock, W. O. (European Organization for Nuclear Research, Geneva (Switzerland)). 16 Jun 1975. 49p. Dep. NTIS (US Sales Only) $5.50.

The report describes the origins and development up to 1970 of the collaboration that now exists between the European Organization for Nuclear Research (CERN) and its counterpart, the Joint Institute for Nuclear Research (JINR) at Dubna, USSR and also with the Institute for High Energy Physics, Serpukhov, USSR. Part I deals with the relations between JINR and CERN, their beginnings and the subsequent development of exchange of scientists, joint summer schools, and the organization of Seminars to discuss perspectives in high energy physics. Part II describes first the steps which led up to the signing of an Agreement between CERN and the State Committee of the USSR for the Utilization of Atomic Energy, governing collaboration between CERN and the Institute for High Energy Physics at Serpukhov. A brief account is then given of the subsequent installation of equipment built at CERN for the Institute's 76-GeV proton accelerator and the carrying out of joint physics experiments by teams from Western Europe and from the Soviet Union. Part III summarizes the origins of collaborative agreements which have been made by CERN with a few other leading Institutes in the Soviet Union. A number of Annexes reproduce some of the relevant documents and letters. (auth)

19229 (LIB/Trans-558) FEDERAL EXPENDITURE FOR NUCLEAR ENERGY FOR THE FISCAL YEAR 1975 (GERMANY).

Translated by U. Engelbert From Atomwirtsch., Atomtech.; 19: 562(Nov 1974). 4p. Dep. NTIS (US Sales Only) $4.00.

Details of the federal expenditure for the F. R. G. the year 1975 are given. Important individual expenditure in comparison to budget values 1974 and actual values 1973 are tabulated. (GE)

19230 (STI/DOC-10/166) TRAINING IN RADIOLOGICAL PROTECTION FOR NUCLEAR PROGRAMMES. (International Atomic Energy Agency, Vienna (Austria)). 1975. 122p. IAEA $8.00.

The manual is intended for persons responsible for organizing training programs in radiological protection. Topics discussed in the manual include: classification of training programs; types of training programs currently required; curricula of training courses; and organization of the training. Examples of training curricula, training courses available in various countries, and a suggested syllabus for a training course are all presented in the appendix. (ERB)

19231 (UCRL-52000-75-6) LAWRENCE LIVERMORE LABORATORY ENERGY AND TECHNOLOGY REVIEW. Carr, R. B.; Berlo, R. C.; McCaleb, C. S.; Prono, J. K. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1975. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

Preliminary calculations indicate that the gas-embedded Z-pinch as a fusion reactor may be feasible, and experiments are underway. An in-situ process, RISE (rubble in situ extraction), is being developed for recovering oil from thick deposits of moderately low-grade oil shale. A study was made of the accumulation of radioactive trace metals by oysters following low-level waste releases from the Humboldt Bay (Calif.) nuclear power plant; results indicate that suspended particulates and their resuspension from bottom sediment play an important role. (DLC)

19232 (USNDC-12) MINUTES OF THE USNDC MEETING, 23–24 SEPTEMBER 1974, LAWRENCE BERKELEY LABORATORY, BERKELEY, CALIFORNIA. Bowman, C. D. (National Bureau of Standards, Washington, D. C. (USA)). 1974. 84p. (INDC/US-66(G); NEANDC/US-189(11)).

Much of this meeting was devoted to presentation and discussion of reports of the rather intense subcommittee activity of the past year. Other matters outside of the subcommittees' purview included a thorough discussion of the Table of Isotopes Project and the relationship between it and the Oak Ridge Nuclear Data Project, a detailed review of nonneutron nuclear data needs, a review of the role of the NEANDC, and a discussion of possible changes in the structure of the USNDC which would permit it to carry out its functions with less formal guidelines. The course of the meeting was as follows: Administrative (introductions, agenda, minutes of the previous meeting and past actions); Reports of subcommittees (neutron data applications, standards, basic science, materials science, controlled thermonuclear research, biomedical applications, separated isotopes); Program reviews (cross section studies at Ohio Univ., nuclear research at Western Michigan Univ.); Report on the NEANDC meeting, Tokyo, March 1974; Review of the Table of Isotopes; U. S. nuclear data needs (nonneutron data needs, waste transport and thermal data sets, the 1975 edition of the USNDC request compilation); Compilation and evaluation (CINDA, NNCSC); Status reports; Meetings (plans for the 4th Conference on Nuclear Cross Sections and Technology, 1975, and review of future meetings); and Recommendations. Appendixes are included on neutron cross section discrepancies, basic science subcommittee recommendations, notes on CINDA operations, addendum to USNDC status report from LLL, and action items. (RWR)

Mathematics and Computers

Refer also to abstract 19221.

19233 (ANL-7411(Supp.9)) ARGONNE CODE CENTER: COMPILATION OF PROGRAM ABSTRACTS. Butler, M. K.; DeBruler, M.; Edwards, H. S.; Harrison, C.; Hughes, C. E.; Legan, M.; Menozzi, T.; Ranzini, L.; Strecok, A. J. (Argonne National Lab., Ill. (USA)). Apr 1975. Contract W-31-109-Eng-38. vp. Dep. NTIS $10.60.

This document is the ninth supplement to and revision of ANL-7411. It contains additional abstracts and revised table of contents and indexes. (RWR)

19234 (DUN-SA-139) COMMERCIAL APPLICATION OF FAULT TREE ANALYSIS. Crosetti, P. A.; Bruce, R. A. (Douglas United Nuclear, Inc., Richland, Wash. (USA)). 7 Apr 1970. 42p. Dep. NTIS $5.25.

The potential for general application of Fault Tree Analysis to commercial products appears attractive based not only on the successful extension from the aerospace safety technology to the nuclear reactor reliability and availability technology, but also because combinatorial hazards are common to commercial operations and therefore lend themselves readily to evaluation by Fault Tree Analysis. It appears reasonable to conclude that the technique has application within the commercial industrial community where the occurrence of a specified consequence or final event would be of sufficient concern to management to justify such a rigorous analysis as an aid to decision making. (auth)

Miscellaneous

Physics and Engineering

Refer also to abstract 19223.

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